Aeronautical Engineering Section

June 15, 1929 — *A McGraw-Hill Publication* — 20 Cents per Copy

AVIATION

The Oldest American Aeronautical Magazine

SPECIAL FEATURES

Air Transport PROGRESS IN THE UNITED STATES

Aircraft Control OF LIGHTING FOR EMERGENCY LANDING FIELDS

AERONAUTICAL *Engineering* SECTION

AVIATION June 15, 1929 Vol. 26 No. 24. Published weekly McGraw-Hill Publishing Company, Inc., New York, N. Y. Domestic $4.00 per year; Canada $5.00. All other countries $6.00; 20 cents a copy. Entered as second class matter July 27, 1928 at the post office at New York, N. Y. under the act of March 3, 1879.

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June 15, 1929

VOLUME 26 NUMBER 24

McGRAW-HILL PUBLISHING COMPANY, INC.
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Publishers of

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American Machinist—European Edition (Published in London)

AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

June 15, 1929

Volume 26 Number 24

Bigger and Better Airports

AN AIRPORT can not be too large. The larger it is the better chance a pilot has if his engine quits on the take off and the better are his chances of finding it in bad weather. Also it can be divided into take off and landing areas, and certain parts can be reserved for instruction and others for transport planes.

Large cities can afford to build and maintain large airports even in spite of the high cost of land because of the intensity of traffic. The big passenger airliners are in reality being designed around these large airports. They could not be operated from many of the fields which existed a few years ago or which now exist outside of the larger towns. Their landing speed and the momentum of their weight is too great to allow them to operate safely out of small rough fields. The airliners of tomorrow, as the ocean liners of today, will probably only be able to operate out of certain large ports.

The tendency of the aircraft designers to increase landing speeds as fast as airports are improved is perhaps deplorable, but it is also inevitable. It presents a serious problem for the small town which happens to be along the line of major air traffic. Such a town can not afford to purchase put in the equipment, and maintain, a field of sufficient size to handle our big passenger planes. It would seem as if the individual states would have come to the aid of the municipalities in regard to the major airports of our transcontinental airlines.

//

Unified Activity

WITH the rapid growth of the aviation industry there has come a most amazing growth of organizations whose purpose is to promote flying in one way or another. We have organizations of pilots, mechanics, manufacturers, dealers, distributors, the general public, and many sub-divisions of each, all seeking to advance the cause of aviation.

Too many organizations trying to do the same thing can overlap in their activities, bleed the aviation industry of time and money and greatly dissipate the energy being expended for the advancement of aviation. It would be well to remember that, "In unity there is strength," and though it may hurt certain groups or individuals, the various groups and societies must be consolidated wherever possible in order to unify the activities being conducted, to conserve the time, money, and energy of the valuable men who are giving their efforts to this work and to present a united front to the many grave problems with which the infant aviation industry is now faced.

//

Official Designs

THE DEPARTMENT of Commerce has decreed that all planes shall come out of a spin in three quarters of a turn after having made six turns. This is undoubtedly desirable, but it is doubtful whether, with our present knowledge of design, this really adds to the safety of flying. Regretable as it may be, we have not yet designed planes which will not spin or stall. It is also unfortunate, but apparently true, that a plane which is hard to get into a spin is also hard to get out of a spin. Conversely, a plane which is easy to get out of a spin is also easy to get into a spin.

According to available figures, the majority of spinning fatalities start at altitudes of less than three hundred feet, and at this height it is very difficult to get out of a well developed stall or spin. Designers are doing their best to develop planes that will only spin under unusual circumstances and which will come out of their spins easily.

This safety measure which has been adopted by the Department is distinctly open to controversy. What is even more serious, is that it is one more step toward the complete domination of aeronautical engineering by the officials at Washington. It is easier to pass safety regulations affecting design than it is to repeal them, and it will not be long before the civil handbook controls commercial airplane design as thoroughly as the Army and Navy handbooks control military design. Such a condition would in our mind be deplorable.

Air Transport PROGRESS IN THE UNITED STATES

WITHOUT DOUBT, the United States is embarking upon the greatest era of air transportation the world has yet witnessed. The year 1929 seems destined to usher in the definite realization, in a larger way than ever, the results of many years of pioneering, painstaking effort and accomplishment. Ample capital is available, the aircraft manufacturers are developing and producing without limitation, airways are being established, and nothing seemingly stands in the way of a full realization of air transportation in all its phases and with all its possibilities.

Since the World War, when a large quantity of surplus military aircraft was released for sale, commercial air transport has been in the making. First came the beginning of the air mail service with army pilots flying the mail between New York City and Washington. Next, the establishment of the Transcontinental Airway with its mail service from coast to coast. Later, the lighting of the route, the addition of other routes, and now the great 20,000 mi. network of aerial highways with their lighting equipment, intermediate fields, attendants, radio and weather service, are all a matter of history, and air mail has become an essential part of our daily lives.

Only in the last few years, almost in recent months, have the commercial air transport companies turned their attention seriously to the transportation of passengers. There have been pioneer lines to be sure, the majority of them operating successfully and furnishing excellent services but the current year marks the next great step—the enlargement of this service to an extent that will cause us to take it for granted and to depend upon it, even more that we have come to accept and utilize the air mail.

Croydon Airport, which serves London, as seen from the gallery outside of the control office on the field

WE HAVE ALREADY witnessed the inauguration of several important services, both national and international. They have demonstrated their need. We are to have at least two additional transcontinental lines devoted primarily to passenger service, and practically all air mail contractors are making plans to include it, with larger and more powerful planes to supplement those which have been pioneering the routes through all sorts of weather and throughout the twenty-four hours of the day. Passengers will ride comfortably in easy chairs and berths, their wants attended by uniformed stewards, and traveling by air will take on the comfort of a Pullman journey.

Within the United States, there exist all the fundamentals needed to fashion successful air transport lines and services to any extent for which

An Exceptionally Interesting Description of Present Conditions and of How We Have Profited from the Experiences of European Airway Operators

By MAJ. CLARENCE M. YOUNG
Director of Aeronautics, U. S. Department of Commerce

there could possibly be a demand. Our present transport planes measure up to the best to be found elsewhere. They compare favorably with those in use by the recognized airlines of Europe, such as the Imperial Airways of Great Britain, the Luft Hansa of Germany, and the K. L. M. of Holland. And there is no question but what the aircraft and engine manufacturers of the United States, who have made such tremendous strides in the last few years as the demand for new and more efficient aircraft has developed, will keep us in the van of other nations in the production of large, powerful air liners that will be very safe and extremely comfortable as well.

There is, perhaps, no one who possesses a better understanding of air transport in this country than Major Young. His position as Director of Aeronautics, a position which incidentally he has filled to the eternal credit of American aviation, has enabled him to study the entire picture from every angle.

That Major Young also possesses a good understanding of conditions in Europe is born out by the fact that he recently returned from an eight weeks' trip abroad during which time he flew over practically every European airline in his Wright "Whirlwind" powered Stearman biplane.

We possess already a vast network of properly equipped airways which follow, in the main, the trade trails of former eras of transportation. These airways are constantly being added to, and the near future will see practically every important industrial center in the United States linked up in this rapidly developing aerial highway system.

Due to the forethought and enterprise of both municipalities and individuals, there are being developed in the United States some of the finest airports to be found in the world. And when it is realized that the major portion of this work has been undertaken within the last three years, one cannot help but be impressed with the tremendous possibilities immediately ahead, and the extent to which we already rely, perhaps unknowingly, upon air transportation.

DURING the last three years privately operated companies have developed scheduled air transport services covering 50,000 mi. daily—twice the distance around the earth at its greatest circumference. Schedules are maintained with precision throughout the 24 hr. of each day, over mountain ranges and through all sorts of weather. During this same period personnel has been trained, airways have been established, radio and weather services organized, extremely valuable experience has been gained, and it all furnishes the premise for added transportation services that will equal or exceed any which exist elsewhere.

In giving consideration to the existing air transportation services in the United States, from any point of view, it is necessary to be mindful of the fact that they have been developed without government subsidy, or direct aid of any kind, such as many European lines enjoy. Sometimes one is apt to confuse air mail contracts with subvention in some form or other, but such is not the case. To be sure, the transportation of air mail by private enterprise has been the important factor in building up existing scheduled services, but air mail contracts are awarded upon the basis of competitive bidding, and the holders thereof perform a definite service for any amounts received. The only service which borders upon government aid is the establishment and maintenance of the airways, but this is similar to the lighthouse and navigation service that has been rendered shipping for many years. It cannot, therefore, be considered in the light of a government aid peculiar to air transportation.

All things considered, air transportation in the United

States is building upon its own premise with its own initiative, and will advance to any stage where a service can be rendered—and the limitations are comparatively few.

The question has frequently been asked—what have we to learn from the extensive experience gained in the transportation of passengers by various European organizations over a period of approximately ten years? It cannot be answered in an off-hand manner, because of some important differences which become manifest when comparisons are made.

A fundamental which must exist in any successful air transportation system, whether it be in the United States, Europe, or elsewhere, is made up of a combination of three things: reliability, speed, and comfort. This involves practically all elements entering into such a system—aircraft, pilots, ground personnel and equipment, airways, schedule maintenance, radio and weather services, etc. No substantial variation is permissible. Any differences which may exist are, therefore, limited to such things as the extent of the service, the schedules maintained, the length of the routes, and to the details and refinements which are developed as experience is gained.

A number of European lines are operating excellent services. Some of them involve difficult conditions, such as water crossings, mountain hazards, fog, etc., and one cannot help but pay his respects to the success with which their operations have been conducted. Their routes, as a rule however, are comparatively short, a circumstance which simplifies schedule maintenance and operation to a considerable extent. For example, the flight between London and Paris is but two and one-half hours; between London and Brussels a trifle less, with an additional hour and ten or fifteen minutes between Brussels and Cologne. London and Amsterdam is relatively the same, while Paris and Cologne are approximately three hours apart, and Cologne and Berlin about three and one-half hours. A somewhat similar condition exists from Paris south to Marseilles, etc., and from the actual operating point of view, a favorable set-up has been developed.

Above: Major Young standing in front of the "Whirlwind" powered, Stearman biplane in which he made the tour of Europe. Below: An air view of Tempelhof Airport

The routes and schedules in the United States are substantially different. A transcontinental service involves an airline distance of approximately 2,700 mi. It crosses three mountain ranges, and calls for both night and day flying, and requires aircraft properly adapted to such a service.

A VERY SIMILAR situation exists in a north and south operation, or in practically any direction where through services are contemplated—and it is the through, long-haul service which offers the greater economies in the matter of time, and justifies the cost differential which the users of transportation are willing to pay. Assuredly, there are many locations in the United States where conditions of terrain, or the absence of other transportation, make air transportation over comparatively short routes advantageous and profitable, but because of the vast area of the country, lengthy schedules need be contemplated when consideration is given to air transportation as a comprehensive national service. The difference in this respect between air transport operations in the United States and in Europe is at once quite apparent.

Chicago Municipal Airport, the terminal of 14 air transport lines

THE LENGTH of the routes and the nature and extent of the service also reflects itself in the amount of equipment needed on airways. Radio communication and weather services become somewhat more complicated; intermediate fields, night lighting equipment such as beacons, boundary markers, obstruction lights, flood lights at terminal fields, etc., all enter the picture and confront the air transport operators in the United States with substantially different conditions than exist elsewhere, and with which they undoubtedly have had the greatest amount of experience.

To offset any disadvantages which may seem to present themselves in connection with longer routes, more ground equipment, etc., (and they are merely differences rather than disadvantages) is the fact that the services operating wholly within the United States are not or will not be concerned with the more or less annoying business of passports, customs, etc., caused by the many border crossings in Europe. Many of the air journeys there, even though they are but of two or three hours' duration, put one in entirely different countries, with different languages, different customs, and involve the usual examination of passports and luggage, and the formalities of immigration, public health, etc. Here we can fly almost 3,000 mi. and still be in the same country, and never see nor hear of a passport of customs official. It all reflects distinct advantages in the general scheme of things and will react most favorably in our air transportation system.

THE FOREGOING is by no means an attempt to indicate that air transport organizations in this country cannot profit by the long operating experience of the European lines. As a matter of fact, a number of the representatives of such organizations have visited Europe at various times for the purpose of studying their methods, and undoubtedly many things have been put into effect here as a result. At least one important phase are the details and refinements—the comparatively minor things which either irritate or gratify the users of air transportation and furnish the premise for their attitude toward the system as a whole. The manner in which they are transported to and from the airport, the facility with which luggage is handled for them, the ease with which they are transferred to and from the aircraft, their comfort in the aircraft while en route, etc., furnish examples of the items referred to. Such details are fitted into the picture only as a result of experience—an acquired knowledge of the needs and desires of the persons concerned. They may appear relatively unimportant—the actual transfer of passengers from one location to another may seem to dominate all other phases. It does, of course, but not in the mind of the passenger. He either does, or will, take that for granted, but he will not overlook the fact that he was obliged to trundle his own luggage in a taxi to the airport, find his own way to the aircraft via the propeller blast, locate his own seat reservation, amuse himself en route by wondering what location he is passing over, whether the aircraft is on schedule, where a blanket is when the altitude makes the cabin chilly, why the belt contraption on his seat, and to worry about the aircraft bouncing around in rough air without knowing that it is a normal condition in the particular locality. These and many other similar things are of slight consequence to the operations manager, but they very definitely leave their mark on the passenger—and after all he is the source of revenue and must be the one who is satisfied. The air transport organizations, therefore, would seemingly do well to take such items into major consideration and put them into effect in the beginning rather than to later attempt to overcome any prejudices which their absence will surely create. Most of the European lines have surely given this phase of it a great amount of thought and development. And this is one reason why the European air passenger lines are so highly regarded by the layman today.

Within the United States a thorough knowledge of the fundamentals of air transportation exists, extensive experience with the operating conditions has been gained, airways have been established, equipment and personnel are available, and the users of transportation of any kind will soon find themselves confronted with air services so comprehensive and satisfactory that they cannot help but use them and eventually take them for granted in the same manner they do the railroad, the steamship, and the automobile.

THE GENERAL AIRPLANES "Aristocrat" CABIN MONOPLANE

FOLLOWING a long period of service tests in accord with its policy regarding new models, the General Airplanes Corporation, Buffalo, N. Y., has started production of the "Aristocrat" cabin monoplane. During the tests, which have been in progress since the first plane was completed in July, 1928, the craft has been flown by about 60 pilots and has had 90 hr. or 8,100 mi. in cross country service. The plane was recently uncovered and disassembled, inspected and rebuilt for further service tests.

The Aristocrat is a three place, externally braced type powered with the seven cylinder Warner "Scarab" radial air cooled engine which develops 110 hp. at 1,850 r.p.m. The plane has a wing span of 36 ft. 4 in., an overall length of 25 ft. 2 in. and an overall height of 7 ft. 7 in. The weight empty is 1,248 lb., the pay load 365 lb. and the gross weight, 2,110 lb.

In performance tests the Aristocrat developed a high speed (full load, at sea level and in level flight) of 100 m.p.h., high speed at 5,000 ft. of 105 m.p.h., a cruising speed of 90 m.p.h. and a landing speed of 40 m.p.h. The rate of climb at sea level is 650 ft. per minute and the plane climbs to 5,000 ft. in 9½ min. and 10,000 ft. in 26½ min. The service ceiling is 12,150 ft. and the absolute ceiling 14,700 ft.

Twenty-five airplanes were to be built during the first two months of production, twenty during the third month and twenty-five per month thereafter. The plane is manufactured under approved type certificate No. 117 and in conformance to the requirements of the Army, Navy and the I.C.A.N. One of these airplanes is being used by Commander Richard E. Byrd in the Antarctic.

Wings are constructed of wood. The spars are of solid laminated spruce with additional hardwood facing strips at the point of strut attachments. The ribs are conventional Warren Truss type, constructed of spruce and reinforced with plywood. Standard Air Service type drawn rods, one set at the top of the spar and one set at the bottom of the spar, are employed as the method of internal drift bracing. The ribs are attached to the spars by means of hardwood angle blocks, screwed and nailed on each side. The drag ribs are a specially constructed box type, with straight spruce members between the spars, top and bottom. There is a curved spruce cap strip at the top to form the wing contour, and plywood reinforcements on either side of the spruce members.

The wing curve employed is the General Airplanes Corporation G.A.C. No. 500 and is the high lift type of curve, giving ample depth for an economical design of wing spars. The ailerons are of the entering edge balance type, extending the total length. The aileron control is entirely inside of the wing and the aileron bearings, as well as the bearings on the operating mechanism, are of the ball bearing type. A 20 gal. gasoline tank is carried in each wing next to the fuselage and the drag bracing at this point is plywood on the under surface of the wing. The rib spacing, outside of the propeller slipstream, is 18 in., with extra nose ribs between the main ribs.

The contour of the entering edge of the wing is maintained by an aluminum alloy sheet, covering top and bottom as far back as the front spar. The wing is fastened to the fuselage structure by pin jointed fittings with ample size bolts, assuring plenty of bearing area. This is also the case at the point of attachment of the lift struts to the wing spars. The wing struts are of stream-line tubing with adjustable fittings at one end. Great care has been given the design of these fittings

Interior view of the cabin looking forward

Above: Front quarter view of the "Scarab" powered "Aristocrat" monoplane. Below: The interior of the cabin looking toward the rear

both as to their attachment to the tubes and the allowance for large bearing area at the bolt connection.

The fuselage is of conventional design employing chrome molybdenum steel tubing throughout, with a detachable engine mount on which is mounted the oil tank and complete oiling system before the same is assembled to the fuselage proper. Hot red oxide primer is pumped through the fuselage while the outside of the structure is protected with one coat of red oxide primer, on top of which is applied an aluminum varnish. The sides, top and bottom of the fuselage are made in the form of a Pratt truss. The lift struts from the wing are fastened to two sturdy flat sheet metal fittings completely surrounding the longerons. The fairing over the center section and top of the fuselage is of formed round aluminum tubing, welded and clamped to the steel structure, thus making a very light and rigid streamline former over the fuselage.

A rigid pyramid of tubes under the pilot seat takes the landing gears shock absorber unit, which is composed of hard rubber compression disks. To these built-up shock absorber units are fastened sturdy, yet light, aluminum alloy landing gear legs. These legs are pivoted just below the longeron with two large size pins at the front and rear of the leg, distributing the load well along the longeron. The legs continue as an overhung beam, tapering to the point of attachment of the axle which carries the wheel. The whole unit is nicely faired with an aluminum alloy streamline housing, inside of which is carried the brake operating cable. The brake cables run over pulleys to the rudder pedals, and are operated by the pilot's heel, thus allowing the ball of the foot to be on the rudder pedal at all times. With this arrangement both brakes can be operated simultaneously or individually. This, in combination with the tail wheel arrangement, which operates through more than a 180 deg. angle, allows the pilot to taxi to almost any position with great ease. Tires 30 in. x 5 in. are standard equipment on the Aristocrat.

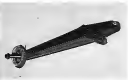
The type of landing gear used is quite simple and very durable. There are only two large size bearings, which take all the wear. The tail wheel is an aluminum casting with roller bearings and a 10 in. x 3 in. pneumatic tire. It is mounted in a fork which is free to swivel 360 deg. in an aluminum alloy casting hinged about a horizontal axis at the base of the tail post. Shock absorber cords are attached to the fork which prevent the latter from making a complete circle and which insure directional stability while taxiing.

A CONSIDERABLE AMOUNT of attention was paid to the design of the tail wheel and mechanism in order to eliminate wear on the working parts as much as possible. The tail post, at the point of attachment to the tail wheel gear, is perpendicular to the ground line with the tail down in order to give the desired castor effect. The rudder is hinged to the tail post in two places and is cut out to clear the tail wheel.

The tail surfaces are constructed of welded steel tubing. The stabilizer is braced by a strut from the lower end of the tailpost and, in addition, a wire runs from the top of the stabilizer spar to the fin. The stabilizer is adjustable in the air by means of a self-locking square thread, operated by a drum and cable mechanism within reach of the pilot.

The flying controls are conventional and of the stick type. Great care was given to the design of the operating bearings in order to eliminate wear and slackness.

The elevators are operated from the stick control by means of cables under the floor. The ailerons are operated by means of cables from the stick by way of the forward lift strut to the entering edge of the wing, where they join a bell crank which is fastened to the front spar. This bell crank operates the aileron connecting tube which passes through the neutral axis of both spars, thus keeping the entire aileron control inside the wing structure. Necessary inspection doors and windows are installed



A photograph showing one of the landing gear legs of the "Aristocrat." Three units are of riveted aluminum alloy and employ rubber disc shock absorbers

for proper check-up and inspection. The rudder is operated by means of extra flexible cable which passes from the rudder pedals over pulleys to the rudder lever.

The Warner "Scarab" engine, developing 110 hp at 1,850 r p m , is standard equipment in the Aristocrat. The structure is so designed as to accommodate an Eclipse hand starter. An exhaust collector ring is mounted on the forward part of the engine with a connection at the lower end passing through the carburetor air heater. A manually operated butterfly valve in this tube regulates the amount of hot air so that proper operating conditions exist in any temperature. A cabin heater can be supplied when desired.

By having the exhaust collector ring around the lower part of the cylinder and in front, a certain amount of heat is distributed over the crankcase and the lower part of the cylinders for cold weather flying. This collector attachment is so arranged that a manually operated shutter can also be installed to regulate the heat. In this way the Scarab can be flown from extreme high temperatures to extreme low temperatures and still maintain the desired temperature around the engine. A metal propeller is standard equipment on the Aristocrat plane.

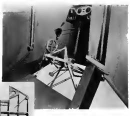
As previously stated the gasoline system consists of a 20 gal. tank in each wing next to the fuselage. These tanks have a half-pint sump in the bottom into which is attached a water drain and a finger strainer in accordance with Air Corps standard practice. The lines then lead down the side of the fuselage to a three-way valve connection, whereby gas can be taken from either or both tanks or both tanks can be balanced. From this three-way valve connection a line runs to the lowest point in the gasoline system at which point a C-1 Air Service type strainer is installed. A line with flexible connections at the strainer and at the carburetor completes the system. Great attention and careful consideration have been given the gasoline system to make sure that the engine is properly fed during all maneuvers of flight, and at no point do the lines enter the cabin. The gasoline tanks are of unusually thick aluminum sheet with welded joints and are extremely rigid but quite light in weight.

The oil tank is of 4 gal. total capacity, made of the same material as the gas tank and is installed between the engine and the fire wall and is detachable with the engine and the engine mount. A one-piece fire wall, which is attached to the main fuselage structure before the detachable engine mount is installed, gives the required air tightness so that no oil or gas fumes can penetrate into the cabin.

Large, well upholstered seats and laminated glass sliding windows along the entire cabin give the passengers all that can possibly be required in the way of comfort, light and good vision. The laminated plate glass windows just ahead of the pilot and on each side of the cockpit slide back to allow the pilot good vision forward and down in bad weather flying.

The Warner engine is so mounted on the front of the plane as to allow the pilot good vision over the top of the engine as well as out of the side windows of the plane.

The pilot sits alone in the front part of the cabin. The



The cabin interior with seat and a portion of the floor removed to show the shock absorber pyramid of welded steel tubes

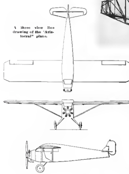
An uncovered wing panel of the "Aristocrat" showing some of the construction details

fuselage, while giving plenty of room at this point, is narrow enough to insure good visibility out of both sides. Where dual control is required, arrangements are made to carry a second control stick and a second set of pedals to be operated from the rear seat of the Aristocrat.

The cabin of the Aristocrat is upholstered in two tone effect, the color of which blends with the outside scheme of the plane. An instrument panel, containing altimeter, tachometer, oil pressure gage and oil thermometer, is

Photograph showing the chrome molybdenum steel tube fuselage structure of the "Aristocrat" monoplane after it has been removed from the assembly jig

A three view line drawing of the "Aristocrat" plane.



installed on the dashboard. This panel together with the air speed indicator, engine switch, primer, flying light switches and other necessary equipment, gives a pleasing appearance to the front of the cockpit. A standard Air Corps type engine control unit is installed in the front cockpit to the left of the pilot.

The doors on either side of the cabin are supported by two sturdy hinges which are bolted to the structure. This prevents the doors from loosening up, a frequent occurrence when hinges are wood-screwed to a separate frame. The baggage compartment, at the rear of the cabin seat, is accessible from both the cabin and the outside of the plane.

The remarkable performance of the Aristocrat in getting in and out of small fields goes far toward making it an ideal plane for cross-country flying. The Aristocrat is easy to handle as it can be flown "hands off" under normal weather conditions.

The officers of the General Airplanes Corporation are: Charles S Rieman, president; LeRoy A Listug, vice-president and treasurer; A Francis Arcier, vice-president in charge of operations; George A. Townsend, secretary and sales manager; Donald A Boyden, assistant sales manager. These officers, together with the following, constitute the board of directors: Evan Hollister, H J Freyn, Alfred Marchev and Oscar Stoffels.

James H Steenson is assistant to the president and general manager; A E Smith, factory superintendent; Fred Bettiger, assistant factory superintendent; Leo Bauer, chief inspector; and R Z Peck, field and service engineer.

The specifications furnished by the manufacturers are as follows:

Length overall	25 ft 2 in.
Height overall	7 ft 7 in
Airfoil (wing section)	G A C No 500
Span	36 ft 4 in
Chord	6 ft
Area of wings, total	194 5 sq ft
Area of ailerons	19 46 sq ft
Area of horizontal stabilizer	11.24 sq ft
Area of elevators	10 92 sq ft
Area of fin	1 82 sq ft
Area of rudder	7 47 sq ft
Weight empty	1,248 lb.
Pay load (fully equipped)	365 lb
Disposable load	862 lb
Gross weight loaded	2,110 lb.
Power, plant, hp and r p m	110 at 1,850
Wing loading	10 3 lb per sq ft
Power loading	18 18 lb per hp
High speed (full load: sea level and in level flight)	100 m p h
High speed at 5,000 ft	105 m p h.
Cruising speed (1,670 r p m)	90 m p h
Landing speed	40 m p h
Take off run (still air)	300 ft
Climb at sea level	650 ft per min
Climb to 5,000 ft	9½ min
Climb to 10 000 ft	26½ min
Service ceiling	12,150 ft
Absolute ceiling	14,700 ft
Gasoline consumption at cruising speed	6½ gal per hr
Gasoline capacity (normal)	40 gal
Range at cruising speed	540 mi
Endurance at cruising speed	6 15 hr
Cost of plane F A F , Buffalo, N Y	$7,500

Aircraft Control OF LIGHTING FOR EMERGENCY LANDING FIELDS

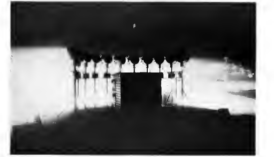
By GUSTAVE E. HEBERLEIN
Switchboard Engineer,
Westinghouse Electric and Manufacturing Company

AMONG the noticeable tendencies in the growth of aviation is the increased attention placed on suitable landing fields With the acquisition of numerous landing fields, and the resulting necessity for lighting equipment, a new problem presents itself

If the use of emergency fields is going to be extended, some means of control for floodlighting must be provided It is not practical to keep these fields floodlighted during all hours of darkness Illumination for landing fields calls for large amounts of electric power and expensive lamps, not counting the cost of the auxiliary equipment The ordinary floodlighting projector using a 3-kw lamp for its source of illumination and projecting approximately a million beam candlepower, costs fifty cents an hour for the power consumed at current power rates and cost of the lighting bulb Several such lights are required for adequate illumination of a runway The future emergency field located on important air lanes between large cities cannot be illuminated during the hours of darkness unless heavy air traffic could justify the expenditure

Watchmen cannot be considered dependable, since in case of inclement weather they would not be able to distinguish a plane in distress sufficiently in advance to render assistance, also the element of human error enters in

Radio, light and sound are the only means available for communication between aircraft and ground. Radio offers a medium of control that at present is somewhat expensive and the equipment is heavy and complicated. In addition, the limited wave channels at present available prevent extensive use of radio as a means of control With the rapid advance being made in the art of radio, a solution of these difficulties may be reached to permit the aircraft of the future to be equipped with a single fool-proof radiophone that can be used as a means of communication and control, for emergency landings While successful control by means of light has been



Newark Metropolitan Airport at night after the lights were turned on during experiments with a sound signal device

A battery of 12 floodlights at the Newark Metropolitan Airport Newark N J

demonstrated by various experimenters, the use of light sensitive devices has proven more or less limited Most of the attempts at remote control have used a scheme whereby the light received by a photo-electric cell on the ground from an aircraft equipped with searchlights was used as the signalling medium The chief limitation of this scheme is that the aviator must locate his landing field with the plane searchlight before the control can be accomplished Obviously this is an undesirable situation, since in case of fog or darkness the field cannot be seen Since the device is dependent upon the intensity of the light beam, operation at a distance cannot be obtained Further, the photo-electric apparatus must be disconnected during the daylight, another disadvantage

THE THIRD ELEMENT available for control purposes is sound. Here an advantage is present over that of light in that a sound wave is not usually directional. The pilot can locate a field in fog, in darkness or in daylight providing the signal from the plane can be picked up by an emergency field located within the radius of action of the sound device In addition, if a sound device resonant at one particular frequency is used, operation can be had independent to a large extent of the volume of sound, permitting operation at a distance or at close range.

Some time ago a test was conducted between the night air mail flying from Cleveland, O, to Bettis Field, Pa, in which the airport lights were energized by a relay operating from the sound of the plane's engine In this demonstration, the receiving sound relay was tuned to the particular engine used, and as soon as the plane came into the radius of action of the relay, the sound of the engine actuated the relay, turning on the flood lights The sound relays could be operated at large distances by the noise of the plane's engine but this extreme sensitivity brought out one disadvantage The noise of engines on motor trucks or passenger cars, when the engine was speeded up, would energize the relays and turn on the lights, even though the particular automobile was quite a distance from the field Since the chief cause for forced landings is the case of engine failure the use of the engine as a sound signal device is out of the question

The sound signal device to be practicable must be of some special nature which will operate as long as the plane is in motion or aloft. A wind-driven siren will meet these requirements, for as long as the plane is in motion the siren can be operated In addition, the siren offers other advantages. It is light-weight, simple, fool-proof and can be used for other purposes as will be pointed out

As the wind-driven siren starts to rotate from rest, the sound frequency varies from zero to some high pitch determined by the siren speed and the number of ports on the periphery The fact that the siren operates between certain limits of frequency is particularly advantageous for use in control of the airport since the receiving relay can be set for one definite pitch and the siren must pass through that pitch as it gathers speed

If a sound sensitive device is used as a relay, it must necessarily be one which will respond only to one particular signal and it must be sensitive and dependable The airport lighting relay is built around that principle The heart of the device is a selective reed relay and a Knowles "Grid-Glow" tube. The reed relay proper consists of a mechanically tuned steel reed actuated by an electromagnet This reed is sensitive to only one pitch or frequency of the many in the audible sound range The Knowles tube is a neon gas tube which can be set in operation by an infinitely small amount of energy, but it will release an appreciable amount of energy. The tube can operate an electro magnetic relay directly It

has been said of the tube that it can be set in operation by as much energy as a fly expends in crawling up one inch of wall. When the tube is in operation it glows with the characteristic pinkish glow of the neon gas street sign. The tube passes an electric current proportional to the intensity of the glow. This current is utilized to operate the field switches and contactors of the floodlight circuits.

To pick up the sound waves from the siren on the plane two or more microphones or "electrical ears" are used. The microphones are installed about the boundary of the emergency landing field. The use of more than one microphone is necessary to enlarge the radius of action of the airport relay.

When a sound wave is picked up by a microphone the wave is converted into electric impulses of the same frequency as the sound wave. The electric impulse is passed on to the reed relay. If it is of the correct frequency the reed relay closes its contacts, which upsets the balanced state of the Knowles tube, causing its operation. Immediately sufficient electric current is passed to operate the relays which, in turn, energize the field lights.

To minimize any chance of false operation, a time delay is incorporated in the reed relay, so that it is necessary that the frequency change at a certain definite rate in order to actuate the device. False operations from stray whistles, extraneous noises or other disturbances is thus minimized.

The airport lighting relay was recently demonstrated at Newark, New Jersey, Municipal Airport, which was particularly well adapted for the test. In addition to hangar, wind cone, boundary and obstruction lights, the field has three banks of flood lighting projectors with a total of 24 000 000 beam candlepower. For the illumination of either of the two runways, the cross runway or the main runways, it is necessary to have two of the three banks illuminated. The present practice entails the use of a watchman who lights the field for either of the runways, depending upon the wind direction, as a plane circles for landing. Besides the lighting equipment already mentioned, there is a ceiling projector, a revolving beacon light and an auxiliary emergency arc light projector.

The wind driven siren used to actuate the mechanism for illuminating the field in tests conducted at Newark Airport

FOR THE DEMONSTRATION the microphone was mounted on the tower of the revolving beacon. Wires were strung from this tower to the airport relay situated in a control field house for the flood lights.

The wind-driven siren, which in appearance is similar in size and shape to that ordinarily used on a fire truck, except having a propeller drive, was clamped to a strut on a Ryan monoplane of the Washington-New York airline. In the cabin were Lieutenant Richard Aldworth, manager of the Newark Airport, Peter J. O'Toole, Jr., supervisor of Port Newark, Robert Illingsworth, Westinghouse lighting engineer, and Pilot Peter Bransom.

Arrangements were so made that, after the plane was aloft, the lights were to be turned off. The plane was to fly across the field three times, each time the siren was to energize the lights and they were to be turned out by attendants on the ground. The fourth time the lights were to be left on to permit the plane to land.

For the first test the plane flew over the airport at an elevation of 1,800 ft. when Lieutenant Aldsworth sounded the siren. The sound hardly had reached the ears of the spectators assembled on the ground when the switches closed and the runway was flooded with light.

The lights were turned out again and the plane sped out to the southward. This time approaching from the south flying at an altitude of 2,000 ft. the siren was sounded when the plane was about 2,000 ft. away. Again the relay went into action and the lights flashed on. The plane then made trips from the east and the west and each time when the siren was sounded the lights were turned on by the relay apparatus.

An amusing incident occurred at the conclusion of the tests after Bransom had landed. Newark Motorcycle Police Sergeant E. E. Tucker conducted an experiment of his own. Sergeant Tucker moved his motorcycle within fifty feet of the microphone stand, with no one aware of his intentions, he started his electrically operated warning siren. As the siren gathered speed, it reached the critical pitch to which the relay was tuned and then the flood lights flashed on. Sergeant Tucker's audience was so surprised that several repeated operations had to be performed to satisfy all. The Newark tests with the airport lighting relay were indicative that the device would aid in removing the hazard of emergency landings. The device itself is inexpensive in upkeep, and the power consumed is less than that needed for an ordinary Mazda lamp.

The simplicity and low cost of the wind-driven siren should prove attractive to aviators, and should aid in the extension and use of this system of airport lighting control.

Ford Motor Company

AND AMERICAN AERONAUTIC DEVELOPMENT

The Trials, Tribulations and Successes of William B. Stout . . . "the Man Who Sold Henry Ford on the Airplane"

By JOHN T. NEVILL

FEW STORIES in American business organization can be found to equal that of the organization of the Stout Engineering Laboratories, Inc., and, later, the Stout Metal Plane Company, in Detroit, shortly after the World War.

William B. Stout, the man around whom both those companies were organized, has been called "the man who sold Henry Ford on the airplane." However that may be, Mr. Stout will be recorded in aviation history as the introducer of the thick winged internally trussed full cantilever monoplane in America, as well as the producer of the first all metal airplane in this country.

William B. Stout, vice-president of The Stout Metal Airplane Company, Division of Ford Motor Company

William B. Stout was born in Minnesota, the grandson of David Bushnell, who designed and built the world's first submarine, a contraption used in Revolutionary days against the British. At the age of 14—that was 33 years ago—William B. built and flew his first model airplane. Stout's model had a propellor of chicken feathers operated by a rubber band—and it flew. He then constructed one, using turkey feathers. It did not fly. Several years later, while a student at the University of Minnesota, he learned why.

There are a lot of interesting things in Stout's life during those years concerning his work in designing and building bicycles and motorcycles, touring Europe as an itinerant journalist, conducting a boys' column on a St. Paul newspaper, and organizing a model plane club, but we will not go into them.

In 1909, Glenn H. Curtiss, who in 1908 had won the Scientific American trophy at Hammondsport, N. Y., brought his famous "June Bug" to St. Paul for an air meet, held in conjunction with a fair and circus. Then and there "Bill" Stout obtained his first view of a real airplane. Instead of helping feed and water the elephants, which work a lot of boys chose, Bill elected to assist the then "dare-devil aeronauts" push their "aeroplanes" around the field. Eugene Ely was there. So was Lincoln Beachey, inventor of the "Vertical Drop," "Dutch Roll," "Ocean Roll," "Turkey Trot," "Figure Eight," and other "death defying" stunts now used in everyday flying. Ely was a Curtiss pilot, and Beachey still was a novice heavier-than-air pilot.

From his experience gained on that field, his subsequent writings, his efforts in model plane work and his lectures on "Artificial Flight" Stout gained somewhat of a reputation in the vicinity. The result being that, in

September, 1912, at which time Chicago held an air meet on the lake front, Stout was asked by the Chicago *Tribune* to coach a crew of their reporters in reporting the meet. Due to this help the *Tribune* scored a "beat" practically every day during the week of the meet.

With the backing of Harold McCormack, Stout then founded *Aerial Age* and edited that magazine for nearly two years, until it was sold to Eastern interests, to later go out of existence following the start of the World War.

Articles on cycling written by Stout for *Motor Age* attracted the attention of the Scripps-Booth people, of Detroit, who brought him to Detroit to work with them in designing and producing motorcycles. Mr. Stout went to Detroit, but instead of helping the company build motorcycles he designed for them a small automobile, later becoming chief engineer, advertising manager, and general salesmanager, respectively, of the Scripps-Booth Motor Car Company.

Shortly before the War broke out in Europe, Alvan Macauley, president of the Packard Motor Car Company, persuaded Stout to go with Packard as aeronautical engineer in charge of building aircraft. As outlined in the last article, the Packard company, for some time, had been experimenting with aircraft engines. It was during Mr. Stout's tenure as aeronautical engineer that the Packard company completed and tested its initial plane engine on the rear end of a truck.

At about the time America entered the War Mr. Stout was called to Washington to act as technical advisor to the Aircraft Production Board, then headed by Howard E. Coffin, of Detroit. He had heard the statement relative to DH's of that date, that out of the total horsepower available, 93 hp. went into lift and 137 hp. into parasite resistance. His first thought, then, was to rid the airplane of as much parasite resistance as possible.

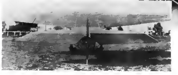
Mr. Stout then advanced his first conception of what later was destined to develop into the Ford transport monoplane of today. His idea was to construct a thick winged internally trussed monoplane, a plane which would be all wing, with but a small nose on which to place the engine. Unknown to him, Junkers had been experimenting with the same type of craft in Europe.

At that time there were no known thick winged airfoil sections, the thickest being the R.A.F. 6. Mr. Stout, however, drew up a prospectus to show the peculiar shape of the plane he had in mind. For structural reasons it had a tapered chord of four to one. The tail surfaces were attached at the center of the span, where, of course, the chord was the deepest. The plane was to be finished with veneer and the pilot was to sit in the wing. So was born the Stout "Bat Wing."

Army authorities did not at first take kindly to Mr. Stout's idea, despite the fact the Aircraft Production Board had approved his proposal, and he had to surmount numerous difficulties in carrying out his plans. Through a friend, W. C. Rands, of Detroit, Mr. Stout finally succeeded in seeing such a plane completed. Mr. Rands later induced C. W. Nash, automobile manufacturer, who in the meantime had become chairman of the Aircraft Production Board, to look it over.

Following its completion by Mr. Rands, the "Bat Wing" was taken to McCook Field for tests. This was late in 1918, after the signing of the armistice. Mr. Stout was given a 150 hp. Hisso to install in the craft for the test flights. Lieut. "Jimmy" Johnson, now with the Buhl Aircraft Company, was assigned to test it. Before the plane could be taken off the ground, however, because of a faulty pump shaft so much steam had been generated that the radiator was blown off.

The shop of Stout Engineering Laboratories, Inc., while the ST torpedo plane was in the course of construction. Note the fuselage jig in the background



Left: Rear view of Mr. Stout's veneer covered, commercial "Bat Wing" monoplane. Note the arrangement of the tail unit and wing

This was repaired and the plane towed to one corner of the field, where it was filled with ice water. Johnson started out, and managed to get the plane into the air, but was compelled to land at the opposite corner of the field because of the steam already generated. Despite the brevity of the flight, the first thick winged monoplane ever built and flown in America had proven the feasibility of this new type of structure.

Mr. Stout returned to Detroit thoroughly convinced that aviation had a definite place in our commercial, as well as in our military activities. His ambition was to construct a commercial plane upon the same principle, except that a four-place cabin and fuselage was to be built beneath the wing. With the backing of R. L. Stranahan, president of the Champion Spark Plug Company, he organized the Stout Engineering Laboratories, and began construction of his plane. Like the plane Stout had designed for the Army, the commercial "Bat Wing," was covered with veneer. Instead of a 150 hp. "Hisso," however, it was powered by a 200 hp. 8 cylinder Packard engine. It was completed in 1921, and

The four passenger commercial "Bat Wing" monoplane in flight

taken to Selfridge Field for tests. Bert Acosta was selected to test fly it. Originally, Acosta intended only to taxi the plane over the field to "feel it out," but it taxied so well on the first attempt that the pilot took it into the air.

Having again proven his design Mr. Stout conceived the idea of building a larger plane. The United States Navy, meantime, had interested itself in the thick winged design, and contracted with Stout to build a large internally trussed twin engined monoplane to be covered with metal.

This plane, known as the ST torpedo plane, was powered with two 300 hp. Packard 1237 engines, and was the first all metal airplane built in the United States. Besides a torpedo it was designed to carry two men, and five hours of fuel. The duralumin obtainable in those days was of very poor quality as compared with the material available today.

The torpedo plane was completed at a great expense, costing the Stout company more than $162,000. "Eddie" Stinson, now president of the Stinson Aircraft Corporation, who had gone to Detroit following instruction work during the World War, was chosen to test it at Selfridge Field in 1922.

Stinson tested the plane under full load, finding it had a maximum speed of 112 m.p.h. He subsequently made 14 flights with the torpedo plane, all of them entirely successful. Although Stout had constructed a set of metal pontoons for the Navy job they were never installed.

When the plane was deemed ready for delivery the Navy Department sent an officer to Detroit to test fly it before acceptance. Because of the great cost of building the plane, Mr. Stout and his associates, gathered on and about one of the field hangars, and fairly trembled during these tests. Their apprehensions seemed to be a foreboding of what was destined to occur. Coming in to land, according to Mr. Stout's description, the naval pilot flew downwind. He had just skimmed over the tops of some trees when a downward current of air struck him. In the words of Mr. Stout, "he made a perfect three-point landing — about 15 ft. too low." Although the pilot was not seriously hurt, the plane was completely destroyed.

Bill Stout has described that day as the "bluest in his business career." Although, having experienced a loss of $162,000 in the Selfridge Field smash-up, he harbored no grudge against the Navy Department, but did feel as though he was "through with government contracts." The Navy Department helped him bear the loss, and two years later Admiral Moffat told him the Navy's share of the 'crack up' expenses "was one of the best investments the Navy Department ever made."

Determined to get a new start, Mr. Stout then consulted several Detroit bankers and lawyers, including Frank G. Smith, vice-president of the First National Bank, and Harold H. Emmons, a lawyer, who, as outlined in the previous installment, had been in charge of airplane engine building during the World War. He desired to get their views as to the best manner of securing backing for a new venture. This venture developed into the Stout Metal Plane Company, forerunner of the present Stout Metal Airplane Company, Division of Ford Motor Company.

The Stout Metal Plane Company came into being during 1923, after one of the strangest methods of business organization on a large scale ever before known. It was decided to secure a large number of stockholders, each to put up about $1,000. Stout mimeographed a considerable number of letters, and mailed them out to influential men all over the country, enclosing within the envelopes a blue print drawing of the plane he had in mind. The recipients of the letters were asked to mail in their checks in order to secure "an education in aviation," and were flatly informed that there existed no likelihood that any of their "investment" would ever be returned. Stout and his associates, including Stanley E. Knauss, now general manager of Stout Air Services, Inc., Colonel Sidney D. Waldon, a prominent figure of the Aircraft Production Board days, and others, supplemented this idea by going about personally and soliciting funds.

The "June Bug," which was brought to St. Paul, Minn., by Glenn H. Curtiss in 1909 and was the first real airplane ever seen by Mr. Stout

After some $20,000 had been collected actual operation of the Stout Metal Plane Company began. With this money the company began construction of a four-place "Air Sedan," an all metal cabin monoplane built around an OX 5 motor, continuing, however, to solicit

additional "stockholders" in order to insure against a cessation of the work At that time only about 15 more or less small companies, including those operating under government contract, were building airplanes for the market

Despite what had taken place and what was taking place in American aviation few men, at that time, dared admit they were inclined to take the idea of commercial aviation seriously As outlined, however, wartime activities in aeronautics had given a number of wealthy men of the nation just enough interest to make them deem it justifiable to gamble on this new and fascinating industry Thus it was that Bill Stout could find a considerable number of men—men who had money to lose—who were willing to "invest" their money with Stout in his venture

With all due respect to the sportsmanship of these gentlemen, it must be stated that Stout and his associates did not find the business of raising this money an easy job Even after beginning operations they found the problem of meeting rent bills, payrolls, and other obligations incidental to operating a manufacturing plant, a difficult one

The matter of finances, in fact, was the Stout company's only real concern Everything else about the building of airplanes had been satisfactorily solved, in the company's own mind, at least The company's payroll amounted to approximately $400 a month To raise this money it was found necessary, time after time, to go out and bring in additional stockholders In that way the payroll was paid at times by outsiders, who

Side view of Mr Stout's "Bat Wing" monoplane. This plane was powered with a 200 hp. Packard engine

bought their way into the company by furnishing sufficient funds to keep the company alive for another week. Such a spirit on the part of those stockholders was not sound business It was not charity Yet, it was not altogether a faith in the future of aviation But was a finer spirit of sheer sportsmanship ever known in the business world?

Edsel Ford owned $1,000 worth of that stock He also bought $1,000 worth for his father William B Mayo was another stockholder So was Charlie Bohn, the Fisher brothers, Walter P Chrysler, Lawrence Buhl, J G Vincent, Harold Pitcairn, R E Olds, Harvey Firestone, P W Litchfield and many others The stockholders, in fact, attained a maximum number of 138, including many of the most prominent bankers and manufacturers of the nation Besides Edsel Ford, Stout, Mayo, Bohn, and Fred Fisher the Board of Directors included J B Book, Jr, Walter O Briggs, Charles T

Flight picture of a modern Ford-Stout monoplane

Bush, Harry R Graham, George M Holley, C F Kettering, Eugene W Lewis, Fred W Warner, Arthur T Waterfall, and R A Stranahan Among the more prominent of the stockholders, in addition to those already named, were Marshall Field, William E Scripps, Earl Holley, Roy D Chapin, Harry M Jewett, Sidney D, Waldon, R W Judson, W S Knudsen, Harold H Emmons, Alvan Macauley, Gar Wood, Albert Champion, Alex Dow, Phillip K Wrigley, B F Everitt, William E Metzger, R L Polk, Horace E Dodge, Arthur H Buhl, E L Claxton, E G Wilmer, C S Mott, Joseph Boyer and E D Stair

Even with such an imposing list of backers Bill Stout's life in those days were not without their dark moments One story Mr Stout tells is this

It was one of those moneyless week-ends, when every official of the company was wracking his brain to avert the shut-down that seemed imminent A payroll was to be met Bills for material were to be paid. Rent was due Other obligations were looming The list of prospective "stockholders" seemed about exhausted In short, a financial crash appeared certain. And it was a glum group indeed that gathered about Bill Stout that Saturday morning to discuss the situation Stanley Knauss was there, as was Glen Hoppin, Stout's brother-in-law, Alex Runkis, George Goin, Walter Engle, George H Prudden, Louis Henry, and Evan Wright, most of whom are still with either the Stout Air Services, Inc, or the airplane division of Ford Motor Company

When a postman walked into the office virtually everyone present thought disgustedly of more bills and gave him little notice Stout, however, was interested by the name printed on one of the envelopes delivered by the mail carrier, and opened it It was from a manufacturer enclosing a check for $1,000 royalty on the sale of a toy golfer Mr Stout, several years before, had designed and forgotten about So the company was safe from bankruptcy, at least for another week or two

The third of this series of articles by Mr Nevill will appear in an early issue of Aviation.

GENERAL NEWS

New Colonial Service Orders 50 Fairchilds

FARMINGDALE (L. I., N. Y.)—Colonial Flying Service, Inc, the new affiliated company of the Colonial Airways System, has signed a 50-plane order with the Fairchild Airplane Manufacturing Corporation here. This order covers various types of planes, including five Fairchild "71's," twelve Fairchild four-place cabin planes and 33 two- and three-place open cockpit sport and training planes The order has an aggregate value of $400,000 The contract calls for deliveries between June 1 and Nov 1 of this year

Fourteen Fairchild cabin monoplanes have been in Colonial service for some time on regular air mail and passenger lines covering the Boston-New York run by the Colonial Air Transport, New York-Montreal by the Canadian Colonial Airways, Inc, and Albany, Buffalo and Cleveland by Colonial Western Airways

The Colonial Flying Service, Incorporated, has been organized to broaden the activities of the Colonial System by operating flying schools, doing taxi work charter and photographic service as well as airplane distribution

At the present time Colonial has thirty-five transport pilots These pilots will form the nucleus for student instructors and from whom much valuable practical experience can be obtained Instruction will be given on Fairchild "71's", "41's", Fairchhild KR's, Fleets, Tri-engined planes and amphibions

United Aviation to Air Investors

CHICAGO (ILL.)—Stockholders of United Aviation Corporation have confirmed the plan whereby the firm is to be merged in an investing concern to be under the control of Air Investors, Inc., New York City Harvey L Williams is president of the latter firm while Lawrence Scudder heads United Organized in 1928 as a holding firm, U.A.C at present controls Scenic Airways, Inc, Wyoming Airways, Inc, Gray Goose Air Lines, Inc, and North Shore Airport Corporation

Announce J-6 Loening Sport

NEW YORK (N. Y.)—Through its distributor, Cox & Stevens Aviation Corporation, Keystone Aircraft Corporation has announced its new Keystone-Loening "Commuter," a four place all-metal dual-control sport amphibion A cabin craft to sell for $16,800 the Commuter is powered with a 300 hp Whirlwind A bullet-shaped nose distinguishes the body of the new model

Detroit Aircraft Corporation Formed in Nine-Firm Merger

Advance Concern Now Named Waco

TROY (OHIO)—Waco Aircraft Company is the new name of the Advance Aircraft Company, this city It was deemed advisable to make the change because of the confusion between the name of the firm's planes and the name of the company The official pronunciation of the name, it is further stated in the announcement of the company, is "Wah-co"

Fairchild Announces KR-21 Training Biplane

FARMINGDALE (L. I. N. Y.)—Fairchild Aviation Corporation announces production of a new model plane especially designed for training purposes to be known as the KR-21, a two-place biplane.

The machine to be made in the newly-acquired Kreider-Reisner plant at Hagerstown Md, is powered with a Kinner 100 hp engine, or at the option of the buyer, with a Warner 110 hp plant Fuel and oil capacity are put at 23 gal and 2 gal., respectively

Equipment it is stated will include airspeed indicator, altimeter, compass dash gasoline gauge, booster starter tachometer, oil pressure and temperature gauges, dual controls, engine cover cockpit covers, logbook tiedown ropes complete tools engine instruction book wiring for navigation lights celluloid inspection windows at all control bearing points, detachable pan, and also oil temperature and pressure gauges in the front cockpit The price complete will be $4 485 with the Kinner and $5 850 with the Warner engine With the latter power plant, the plane is designated the KR-21B

Inspect St. Louis Schools

ST LOUIS (MO)—Representatives of the Aeronautics Branch, inspected aviation schools in this area last week, following adoption by the Department of a plan for nation-wide inspection and rating of civilian flying schools

Lockheed, Eastman, Winton Latest to Join

DETROIT (MICH)—Formation of Detroit Aircraft Corporation, organization of which was first mentioned in Aviation for June 1 at which time Mahoney-Ryan, Aircraft Development Corporation, and Blackburn were stated to have combined, has been announced here through H W Noble and Company, brokerage firm, who directed the negotiations A consolidation of nine companies, several of which are leaders in aircraft manufacture, forms the new organization Included in the merged directorate are some of the highest executives in aeronautical and automotive endeavor, Ford Motor and General Motors officials among them

Detroit Aircraft Corporation was organized by and around the Aircraft Development Corporation, of Detroit, and besides the latter concern, includes Mahoney-Ryan Aircraft Corporation, St Louis, Blackburn Aeroplane Company Michigan, Lockheed Aircraft Corporation, Los Angeles, Eastman Aircraft Corporation Detroit, Winton Aviation Engine Company, Chicago, Grosse Ile Airport, Inc, Detroit; Aviation Tool Company, Detroit and Marine Aircraft Company, Detroit. Present indications are that several other companies will be involved later The nine companies now in the combine makes the consolidated corporation one of the four or five largest aircraft groups in the nation

Edward S Evans is President

Present plans call for issuance of 2 000 000 shares of stock, with $20 000 000 set as an approximate capitalization figure Plans for public financing were worked out by H W Noble and Company, Detroit August Belmont and Company, New York, and Knight, Dysart and Gamble, St Louis

Officers of the new corporation are Edward S. Evans, president Harold H Emmons, chairman of the Board, Carl B Fritsche vice president, Charles A. Parcells secretary, and Edward T Gushee treasurer

Active management of the corporation will rest in the hands of seven men, comprising the executive committee all of whom have been identified with aircraft manufacture, or operation, or both, for considerable time The executive

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Beacon Airways Founds New Firm

National Air Industries A $1,000,000 Development

KANSAS CITY (MO.)—A new million dollar aviation enterprise for Kansas City was announced this week with the formation of The National Air Industries, Inc., a development of the Beacon Airways of America. The new organization, with an authorized capital of $1,000,000, will enter virtually every branch of the aeronautical field—distribution, finance, investments, training of students, etc.

The organization is headed by Franklin Hemmingway as president, William Ong, vice president, Blatchford Downing, secretary, Frank E. Jones, J. J. Lynn and Raymond B. Whiter, directors. Vernon Shannon is director of publicity.

The organization has absorbed the stock of the Beacon Airways of America and its subsidiary, the Consolidated Air College. Both units, however, will be maintained, and new ones added. Distribution will be through Beacon Airways. This company is American Eagle distributor here. Several other makes of planes also are handled. Functions of this division also will include engine and airplane overhauling, painting, airport and hangar construction, aircraft company organization, surveys for aircraft to be used by corporations, a guaranteed used plane department, aerial photography and mapping and an aircraft supply department.

To Form Finance Unit

Consolidated Air College will continue the training of students and will be in charge of J. R. Puckett. He is a former Army instructor and was manager of the Beacon Airways schools at Fresno, Los Angeles and San Francisco before their sale to Maddux interests. He will be assisted by Eddie Angel, who will be chief flight instructor.

A new unit to be formed will be known as the National Air Finance Corporation. This branch will finance the sale of airplanes, student courses and other aviation projects. An investment department will deal in the securities of other aircraft companies.

Mr. Hemmingway has been engaged in aviation enterprises several years. He was head of the Beacon Airways of California until that company merged with the Maddux interests. He came to Kansas City several months ago and organized the Beacon Airways of America with local capital. This company has had a rapid growth.

Circus Underway at Everett

EVERETT (WASH.)—An air circus will be staged here June 14-16 at the Everett Airport. A 13,000 ft. parachute drop is to feature the show.

Aviation Export Section Planned

WASHINGTON (D.C.) — Plans for forming a new aeronautics section of the Bureau of Foreign and Domestic Commerce to stimulate exports of planes, engines, and accessories, are announced by Julius Klein, Assistant Secretary of Commerce. It is rumored that Leighton W. Rogers will be named chief of the section.

Five Travel Airs to Parks

ST. LOUIS (MO.)—Five new Travel Air biplanes were received by freight last week by Parks Air College. The planes were assembled and added to the training fleet which also includes Curtiss Robins and Parks P-1 biplanes.

Simmons Appointed Spartan Foreign Agent

TULSA (OKLA.)—Appointment of Simmons Aircraft Company, Los Angeles, Calif., as export dealer for Spartan airplanes in China, Japan, the Philippines, Hawaii, Australia, and New Zealand, is announced by Spartan Aircraft Company, this city.

Simmons Aircraft, a subsidiary of Steel, Inc., one of the large exporting firms on the Pacific Coast, has been in business for seventeen years. Offices are maintained in almost every principal city of the world. The organization recently went into the airplane exporting business and one of the deals which now looks very promising is the sale of five Spartans to the Bank of Canton, China, for the transportation of gold and silver bullion from Canton to Shanghai. Transportation of precious metals by air has been found necessary because of the bandit infested regions through which auto transports have had to pass in the past.

The new Spartan exporter's quota for the first year is 25 planes, with an increase of 25 per cent each succeeding year. The contract has been signed for a duration of five years.

To Honor Fechet and Moffett

CHESTER (PA.)—Degrees of Doctor of Aeronautical Science will be conferred by Pennsylvania Military College authorities upon Maj.-Gen. J. E. Fechet, chief of the Army Air Corps, and Adm. William A. Moffett, chief of the Bureau of Aeronautics, Navy Department, here June 19. Fifteen Army planes will participate in an accompanying aerial exhibition over the college grounds, to be under the direction of Maj. Hugh J. Knerr, Air Corps commanding officer, Second Bombardment Group, Langley Field. Planes will be sent from that port and from Mitchel and Bolling Field.

Detroit Aircraft Corp. Formed in Merger

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committee follows: Edward S. Evans, William B. Mayo, C. F. Kettering, Harold H. Emmons, Carl B. Fritsche, Eugene W. Lewis, C. S. Mott. Mr. Kettering is a vice-president of General Motors Corporation as is C. S. Mott also.

In addition to all of the officers and all members of the executive committee, the directorate will also include the following: R. E. Olds, R. D. Chapin, Frank W. Blair, Ralph H. Upson, Arthur H. Schwartz, C. W. Harrah, Sheldon R. Noble, J. S. Elliott, Thomas N. Dysart, Harold M. Bixby, P. De C. Ball and Harry H. Knight.

Each Company a Division

In conjunction with the merger announcement, Edward S. Evans, president, said:

"The Detroit Aircraft Corporation will be an operating company in every sense of the word. The aircraft industry is now prepared for a period of intense development, and the Detroit Aircraft Corporation will be a leader in that work. We will apply the well-known Detroit industrial methods to building aircraft of every description. Each of the companies which is now building an established recognized plane, will form a separate division of the parent company, which will direct all manufacturing and selling activities from its Detroit headquarters.

A word may be said of Grosse Ile Airport, Inc., Aviation Tool Company, and Marine Aircraft Company. The first has developed a 403-acre airport on Grosse Ile at which the Aircraft Development Corporation has been operating. More than $100,000 has been spent on this port, which includes a well-protected seaplane harbor. Amphibion service between the airport and the heart of the city is planned.

To Develop New Tools

Aviation Tool Company is formed around patents controlled by the Aircraft Development Corporation, particularly a new automatic riveting device, for use in metal construction. The machine operates similar to a sewing machine, placing three rows of rivets simultaneously. This branch of the merged company plans to develop other tools and machines for use in various aircraft work.

Marine Aircraft Company was formed around a six-place amphibion, which the company plans to place in production before the end of this year. In this connection it will be recalled that the Aircraft Development Corporation last Fall acquired a dual Comet powered amphibion built by a syndicate of Detroit capitalists under the promotion of H. G. McCarroll, former secretary of the Aviation Committee, Detroit Board of Commerce. The plane, known as the Towle amphibion, was purchased, it was said, "for research purposes."

Build Bi-Engined Kinner Amphibion

Strong Detroit Group Backs Cadillac Aircraft

DETROIT (MICH.)—Production plans of Cadillac Aircraft Corporation, a Michigan concern financed by a strong group of Detroit capitalists, were announced recently by H. G. McCarroll, vice president of the company.

Having about completed test flights on the product, a four place dual-engined, amphibion cabin monoplane, McCarroll stated the company will go into production about Aug. 1, on a schedule of one plane a week. The Cadillac company several weeks ago moved into the two story factory building in Northville, vacated last April by Stinson Aircraft, when the latter concern moved into its new quarters. Cadillac has secured five-year leases on the Northville plant and flying field.

The amphibion to be produced by the corporation will carry four persons, including the pilot, with the two 100 hp. Kinner engines, with which it now is equipped. With an optional power plant of two 165 hp. Wrights, it will have seating capacity for five. Its full cantilever type wing has a span of 46 ft. and a length of 31 ft. The hull is constructed entirely of wood, the covering being veneer, although production jobs, McCarroll said, will be covered with duralumin. An unusually spacious cabin, with the four seats located two and two abreast, dual control, and a specially built instrument board are features of the craft, which is known as the McCarroll Duoplane.

Metzger is President

Hiram H. Walker, Walkerville, Ont., is listed as chairman of the board. William E. Metzger, pioneer automobile manufacturer, and organizer of the original Cadillac Automobile Company, is president, McCarroll is vice president, J. Farrand Williams, treasurer, and A. W. Ackerman, secretary.

Directors of the company are Walker, Metzger, Williams and McCarroll, Arlo Emery, attorney, Eugene W. Lewis, banker, G. A. Richards, automobile dealer, H. William Klare, hotel manager, Ralph Fordon, broker, General C. W. Harrah, real estate man, Hugh D. Backus, broker, Wendel Anderson, chain grocer, and Harry R. Graham, capitalist.

California Tour Completed

SAN FRANCISCO (CALIF.)—On June 1 some 26 planes took off from Mills Field and Oakland Airport for a tour of points in California, under the auspices of the National Aeronautical Association. The journey which included stops at Sacramento, Stockton, Modesto, Fresno, Los Banos, Merced and Monterey, ended again at Mills Field June 9. Special programs were given at the various airports.

The New Twin-Kinner McCarroll Duoplane Amphibion

Aerol Award for Women's Race

CLEVELAND (OHIO) — Floyd J. Logan, chairman of the race committee for the National Air Races, announces that a special award known as the Aerol Trophy and to be designated the "Symbol of Flight" will be given the woman winning the aviatrices' cross country derby event, to be run from Santa Monica, Calif. The Cleveland Pneumatic Tool Company is donor.

Plan for State-Wide Club System in Florida

TAMPA (FLA.)—More than 100 Tampans have announced their interest in the formation of an all-Tampa aero club and are now awaiting word from Comdr. Charles T. Blackburn, Chamber of Commerce aviation leader, for the date of an organization meeting. The formation of similar clubs in other Florida cities will be started with final creation of a state-wide organization.

It is believed, according to the announcement, that a plan of this kind will stimulate establishment of landing fields and improvements of present ports throughout the state.

According to the arrangements planned, the clubs will group all activity under a single head, with senior groups including both flying and non-flying branches, and with the junior groups including the same, and in addition provision for ground study, model airplane building and mechanics.

Supreme Firm to New Plant

WICHITA (KAN.)—Supreme Propeller Company will move into its new modern brick and steel factory soon after the first of July, according to S. J. Stone, manager. The factory is 72 by 310 ft., affording 35,000 sq.ft. of working space. A fully equipped experimental laboratory will be located on the mezzanine. As soon as the company can catch up on orders for wooden propellers, it is planned to turn out a special steel propeller on which engineers of the company have been working for some time.

Five Blimps Assured In National Show Race

CLEVELAND (OHIO)—At least five airships racing in a special blimp race, the first of its kind ever to be held in the history of aviation, will be one of the many air derby features of the 1929 National Air Races and Aeronautical Exposition to be held in Cleveland Aug. 24-Sept. 2.

Announcement of this blimp competition, which will be held for a Litchfield Trophy, was made by Clifford W. Henderson, managing director of the 1929 events, following completion of negotiations carried on by him with representatives of the Goodyear-Zeppelin Corporation, makers of blimps. The Goodyear firm, according to Henderson, will supply at least five of the light airships, and it is hoped that both the Army and the Navy may enter the feature with their own blimps.

Henderson said, in referring to the blimps, that these ships will fly formations every day of the National Races, and will commute to and from Cleveland, using their own hangar at Akron. The trophy is being offered by P. W. Litchfield, head of the Goodyear-Zeppelin Corporation.

Makes Outside Loop in Fleet

BUFFALO (N.Y.)—Lieut. F. C. Nelson, Air Corps, is credited with negotiating an outside loop at the local airport, June 4. He flew a standard stock Fleet training plane equipped with Wright J-6 five-cylinder engine. Reports say that Nelson started his maneuver at 7,500 ft. altitude, dived to a level of 2,500 ft., then climbed back upward to complete the loop.

N.A.C.A. to Study Flat Spin

LANGLEY FIELD (VA.)—Study of the flat spin is the aim of research now planned by the National Advisory Committee for Aeronautics here. It is reported that a new five-foot throat wind tunnel is to be set up on a vertical axis especially for the experimental work planned.

Dare to Manufacture Variable Camber Craft

DETROIT (MICH)—Melvin E. Dare, Detroit airplane designer, who for many years has been experimenting toward perfecting a variable cambered wing, announced here recently that he achieved his aim and that his plane, the Dare variable camber, all-metal, low-wing, cabin monoplane, would be placed in production in Detroit within the next 60 days

The present model, the third constructed by Mr. Dare, is powered by ten cylinder, 120 hp Anzani engine and has seating capacity for two, although with slight modification of the cabin's interior the capacity may be increased to three. The Dare wing is constructed in three longitudinal sections, extending three-quarters of the way toward the tips To effect a deep camber the central section is raised, which forces down the leading edge of the forward section and the trailing edge of the after section Both the forward and after wing sections are hinged to the central longitudinal section and move on an axis formed by rigid bars extending out from the fuselage

General specifications of the Dare monoplane as furnished by Mr Dare, are as follows Span, 31 ft. 4 in., Length, 23 ft, height, 8 ft., wing area, 186 sq ft with variable camber area of 124 sq ft, chord at fuselage, 9 ft, chord at tip, 4 ft 9 in, camber of wing in normal flight, 12 in, deep camber, 21 in, gas capacity, 35 gal, oil capacity, 5 gal, weight empty, 1,150 lb, cruising speed, 115 mph, high speed, 135 mph, cruising range, (estimated) 600 mi, landing speed (without deep camber) 60 mph, landing speed (with deep camber), 30 m.p.h

New Firms Announced

AIRCRAFT ENGINE CORPORATION, Philadelphia, Pa, by Robert Glendinning, Jr, Albert R Jacobs and Henry M McFadden, to manufacture aircraft engines.

LENT AIRWAYS, INC, 33 Academy St Poughkeepsie, N Y, capital 100 shares no par value stock; by Ward S Lent, William A Sturgess and John B Van De Water; to deal in aircraft.

AIRPLANE ACCEPTANCE COMPANY, Colorado Springs, Colo, capital 2,500 shares of preferred stock at $100 a share and 2,500 shares of common no par value stock; by J Don Alexander, Robert Rhea and R A Duncan; to finance the purchase and sale of aircraft.

GREAT EASTERN AIR TERMINALS, INC, 347 Madison Ave, New York City, capital 600,000 shares no par value stock, Mortimer B Foster, president, to operate aircraft and air terminals

COLUMBUS FLYING SCHOOL, Columbus, Neb, capital $5,000, by John T Siems, Andrew A Risser Edith Siems and Olga Risser; to offer instruction in the art of flying

Offers 80-Hr. Welding Course

ST LOUIS (MO.)—An 80-hr. welding course has been inaugurated by Universal Aviation Schools to conform with the recommendation of the National Society of Welders Overhead group welds, brazing, and all work required for welders in the aircraft industry will be included in the course.

Statement is Issued Concerning Cooling Fluid

NEW YORK (N Y)—Varied reports as to credit for developing Ethylene Glycol, known as "Prestone," the cooling fluid for aircraft engines, has led the National Carbon Company, subsidiary of the Union Carbide and Carbon Corporation, to issue the following statement

"For several years past, the National Carbon Company has marketed an anti-freeze under the trade marked name of 'Prestone.' As 'Eveready Prestone,' that product has been extensively advertised and used in the cooling systems of automobiles. For several years past, the Carbide and Carbon Chemicals Corporation, manufacturers of this material, has been cooperating with both branches of the Government service in experimenting with 'Prestone' as a possible cooling agent for airplanes We do not feel at liberty, however, to discuss any phase of this necessarily confidential relationship and our purpose in issuing this statement is simply to point out that 'Prestone' was developed originally by the Carbide and Carbon Chemicals Corporation, a subsidiary, as is the National Carbon Company, of the Union Carbide and Carbon Corporation, and that this anti-freeze is sold wholly through the National Carbon Company Obviously, therefore, the widely circulated newspaper reports that any other company has had anything to do with the development of 'Prestone' are erroneous"

Erect New Robertson Barrack

ST LOUIS (MO)—Another barrack for students of Robertson Division of Universal Aviation Schools has been completed With the Robertson Flying Club hotel and the two barracks at Lambert Field, St. Louis, living accommodations for more than 150 students are available. The new barrack is 140 ft. long and 20 ft wide. It has eleven single rooms and eleven double rooms, for 33 students There are shower baths, dining room, electrical fixtures and other conveniences

Berliner-Joyce in New Plant

BALTIMORE (MD)—Berliner Joyce Aircraft Corporation has moved into its new factory building just completed it is announced. The executive and engineering officers in the Hearst Tower Building will be re-located at the factory together with all operations that have been conducted up to the present time at the Alexandria, Va, plant The new factory has 5,400 sq ft. of space

Ninth Baltimore Meet Attracts Many to Logan

BALTIMORE (MD)—The Ninth Annual Air Races and Flying Exhibition was held recently at Logan Field under the auspices of the Flying Club of Baltimore and the Air Corps of the Maryland National Guard before a crowd of some 30,000 people. Maj Sidney Owens, commandant of the Pennsylvania National Guard, won the National Guard race for the second consecutive time. He covered the 36-mile course in 15 min 23 sec. Lieut Harry W Generous, of Connecticut, was second, Lieut Benjamin J Nassef, of Pennsylvania, was third, and Maj William D Tipton, of Maryland, fourth

The second race, open to pursuit or combat planes, was won from the Navy by the Marine Corps Captain Page, Lieut J T, Moore and Captain Rogers were first, second and third, respectively. Captain Rogers won the maneuverability contest. Walter J. Shaffer, mail pilot, whose route is through Baltimore, placed second. The mixed relay race composed of training planes, observation planes and pursuit planes was won by a team composed of Lieut. E W Litch, Comdr D E Watson and Lieut O C. Clark.

In the final heat of the parachute jumping contest Sergt Williard Warner, of the Maryland National Guard, won first prize More than 60 planes, including two tri-engines and one bi-engined transport, were on the field

Schools and Colleges

UNIVERSAL AVIATION CORPORATION'S tenth school was formally opened recently at Memphis, Tenn Offices of the new school have been leased in the Columbian Mutual Tower, with T A Batson sales manager, in charge, and with W Blackwell, in charge, and R D Brown, his assistant, in the city night ground school Lloyd L. Juelson will direct work at the airport.

ERNEST CHRISTIANSEN and Sidney Monnasters are establishing a flying school in Vancouver, Wash

UNIVERSITY OF BUFFALO, in co-operation with Colonial Western Airways, were scheduled to inaugurate an aviation course June 10, with Prof W. Harold Taylor in charge Instruction at the field is under Maj C H. Wooley and W Heath Proctor, director of schools and division superintendent, respectively, of Colonial Flying work is under Chief Pilot Jack Little

AKRON UNIVERSITY students in aviation classes received first instruction at the municipal airport, Akron, June 3

Hart Firm to Offer Aero Suits

COLUMBUS (OHIO)—Hart Manufacturing Company, this city, manufacturer of coveralls and coats for garages and service stations, will also manufacture aviation suits, it has been announced by officials The company has leased a building at 16 E. Livingston.

Alexander Agents In Summer Meeting

COLORADO SPRINGS (COLO)—A summer convention of Eaglerock distributors has just closed here President J Don Alexander Justin McInaney sales manager, and Robert Rhea, head of the Airplane Acceptance Corporation of Colorado Springs, presented to those assembled the new plan whereby Eaglerocks may be purchased on time

The Airplane Acceptance Corporation was organized recently by Colorado Springs capitalists to finance Eaglerock part payment sales.

Those in attendance at the convention included Paul Richter, Aero Corporation of California and Standard Airlines, Los Angeles, James S Charles, Richmond Va, Roy Chapin, Inland Eaglerock Sales Company, Spokane Wash; Rex Kuhl Flora, Ind; William Kysor, Niles Mich, L. W Chandler, Minneapolis Minn, E. W Robertson, Alexandria, Va; Ray Peck, Salt Lake City, Utah; Bob Westover, Billings, Mont., and A W Spence, Rapid Air Lines Rapid City, S D

Soucek Sets 38,555 Ft. Seaplane Altitude Mark

WASHINGTON (D C)—Flying his Wasp-powered Wright "Apache" biplane fitted with flotation gear, Lieut Apollo Soucek established a new seaplane altitude record at Anacostia Naval Air Station on June 4 Calibration of his barographs puts the new mark at 38,555 ft, which betters by 560 ft. the old record of 37,995 ft set by Lieut. C C Champion in the same machine in July, 1927

Lieutenant Soucek took off at 12:28 p.m. and landed at 2 04 p m. The power plant of the plane was fitted with a Roots type supercharger as it was in his record land plane altitude climb of 39,140 ft established on May 8 Fred Neely, of the N A A, was official observer

Plans are now underway for again converting the Apache to a land plane for a new altitude attempt. The German pilot Neunhofer flew a Junkers to 41,795 ft shortly after Soucek's 39,140 ft climb, and the Lieutenant is determined to regain his world record.

Fafnir Opens Aero Division

NEW BRITAIN (CONN)—Establishment of a separate sales division to cooperate with aero companies in the development of ball bearings for use in aircraft construction is announced here by the Fafnir Bearing Company.

Changes Announced In Great Lakes Trainer

CHICAGO (ILL)—Several refinements and improvements in the design of the Trainer combination training and sports biplane, manufactured by the Great Lakes Aircraft Corporation of Cleveland, are announced by Col Benjamin F Castle, president The changes were made following tests of the experimental planes shown at the Detroit show

The upper wing is now being made in three panels, instead of one panel, an adjustable stabilizer is being supplied and an oleo landing gear of improved design is included in the standard equipment Wing slots of the plate design are to be furnished as optional equipment The forward cockpit has been designed to place the occupant on the exact center of gravity so that balance is unchanged regardless of whether one or both places are occupied.

Ames to Retain N.A.C.A. Post

WASHINGTON (D C)—Dr Joseph S Ames, chairman of the National Advisory Committee for Aeronautics, has been appointed president of Johns-Hopkins University to succeed Dr Frank J Goodnow, whose resignation becomes effective on July 1 Dr Ames will retain his place on the N A C A. In a statement to the press, he said, "I do not see anything in my work with aeronautics which would be incompatible with my position as president of the University"

Indianapolis Show Held Over

INDIANAPOLIS (IND)—Interest of the public in the first aircraft show given here in the Exposition Building, State Fair Grounds led Lee H Hottel, manager, to keep the display open June 2 an additional day Some two score planes were on exhibit at the show

Showing Lieutenant A Soucek taxiing on the Potomac River in the Wasp-powered Wright "Apache"

Chicago Agents Form Aero Chamber Division

CHICAGO (ILL)—Following in the steps of the New York aero representatives, dealers and distributors here have organized a division of the Aeronautical Chamber of Commerce to represent the Chicago metropolitan area. This will be another unit in a national chain of such groups

Seventeen dealers and distributors in the Chicago metropolitan area became members of the newly formed division at the first meeting P J Kent, Central Air Terminal Company, was elected as temporary chairman of the group and an organization committee of three dealers appointed.

M M Rubner, Continental Air Services; C B Chapman, Chicago Aero Sales, Inc, and C R Borkland, Air Activities, Inc, were appointed members of the organization committee

Following discussion of aircraft shows and the policy of the Aeronautical Chamber of Commerce, a committee of three dealers was appointed to study the aircraft show situation in Chicago and to make recommendations to the division at its next meeting D MacKenzie, Aviation Service and Transportation Company, J H Livingston, Midwest Airways Corporation, and O B Jones, Pal-Waukee Airport, Inc, were named on the show committee

Besides those mentioned, dealers and distributors in the area forming the new division, included F C Middle, Airplanes Inc, Rex Martin Aviation Sales and Service B C Binley, Curtiss Flying Service of the Middle West, Inc, W Daspit Gray Goose Air Lines, Jacob Jerger, Ravenswood Aeronautical Corporation, Walter Meyers, Walter Meyers, Inc, Jack Oates Jack Oates Inc and Samuel F Kearns, Universal Flying Service

Menasco Plans New Engines

LOS ANGELES (CALIF)—Plans for the immediate purchase of a five acre site and erection of a factory building for the production of two lines of Menasco engines, have been announced here by officials of Menasco Motors, Inc, a Nevada corporation which has taken over the assets of the Menasco Motors Company A S Menasco, will continue to direct the new corporation Although the company has for some time produced converted French Salmson engines the company now plans to build a 260 hp radial air cooled engine, and in addition to produce a four-cylinder, in-line, inverted engine of 100 hp

Furniture Firm Buys Waco

BUFFALO (N Y)—Victor & Company Buffalo furniture and household dealer has purchased an airplane to speed up rural and rush order light deliveries The machine a Waco 10, will be piloted by Walter Peyton

School Inspectors and Their Districts

FLYING SCHOOLS throughout the country are playing host to members of this group of Aeronautics Branch inspectors now in the field gathering data for the new air school ratings Shown here with Clarence M Young, director of the branch, are, top row left to right R L Copsey, George Gardner, Freeman Alberry L W Jurden and R I Hazen Front row, left to right, are J L Kinney, A K Koerbling, Clarence M Young, J S Marriott and Hugh Brewster

Territories and headquarters have been assigned as follows: Copsey, New York New Jersey and New England states headquarters New York City; Gardner Illinois Wisconsin Iowa North Dakota South Dakota and Minnesota headquarters Chicago Alberry Michigan, Indiana, Ohio, Kentucky, Tennessee Alabama, and Mississippi headquarters Detroit Jurden Texas Oklahoma Arkansas and Louisiana headquarters Dallas Hazen Pacific Coast, headquarters Los Angeles Koerbling Missouri Kansas Nebraska and Colorado headquarters Kansas City, and Brewster, Pennsylvania Delaware Maryland, Virginia, West Virginia, North Carolina, South Carolina Georgia and Florida, head quarters Washington J L Kinney and J S Marriott shown above, are assistant chiefs

Approximately 100 air schools situated in various parts of the country, have requested these examinations Director Young declares Only those which make formal application will be inspected he added in making this announcement

New Pheasant Concern Based on Old Personnel

FOND DU LAC (WIS.)—Much of the old Pheasant manufacturing personnel is being retained by T W Meiklejohn, heading Pheasant Aircraft Company here. The old company at Memphis, Mo was recently acquired by Mr Meiklejohn and a group of local business men, and production is now under way on the three-place dual control approved type biplane, which sells for $2,895 with OX-5 power Capital stock of $100,000 was quickly disposed of here

The new company has retained the distributors of the old firm and is now planning to grant additional franchises in order to increase sales representation

Swallow Orders Axelsons

WICHITA (KAN.)—An order for Axelson aircraft engines to the amount of $72,500 has been placed with the Axelson Machine Company, Los Angeles, by the Swallow Airplane Company, Wichita. The power plants will be used in standard Swallow planes as quickly as delivery is made from the factory according to the statement which has been issued

P & W's for 25 Navy Martins

NEW YORK (N Y.)—Announcement is made here that the Pratt & Whitney Aircraft Company, Hartford Conn, will furnish the power plants for the 25 planes recently ordered from the Glenn L Martin Company by the Navy Department

Heywood-Simon Firm Consolidation Approved

DETROIT (MICH.)—Stockholders of the Heywood Starter Corporation and the Simon Airplane Appliance Corporation recently approved a plan initiated by Charles B. Bohn, of Bohn Aluminum and Brass Corporation to consolidate the Heywood and Simon companies into a new corporation to be known as the Sky Specialties Corporation for the manufacture of aircraft accessories.

Officers of the new company are Arthur L Cash, president, F L Riggin, vice-president and Simon D Den Uyl, secretary and treasurer Besides the officers directors will include Charles B Bohn, William B Stout, Stanley E Knauss, Edward Roberts, S L McKay, and John Cowan Jr

It will be recalled that Bohn several weeks ago purchased controlling interest in the Heywood corporation, announcing that he planned to make that company the nucleus of an aircraft accessory manufacturing group The Simon company, it is understood, was subsequently organized by Bohn around a number of accessory patents said to be controlled by Bohn and to supply the merged corporation with $600,000 of working capital.

Mr Cash, now a resident of Marine City Mich, was formerly connected with the old Northway Motor Company Mr Riggin, secretary of the Bohn Aluminum and Brass Corporation will have active charge of the new concern

Naval Aircraft Factory Trying Monel Pontoons

PHILADELPHIA (PA.)—The Naval Aircraft Factory here has begun the construction of Monel metal pontoons and wing tip floats for five new planes of the Vought Corsair type

The new pontoons and floats will be tested to replace the type now in use Monel metal has been found to offer great resistance to salt water corrosion. Silvery white in color, it is said to need no protective coating It has the additional advantage of being kept clean with little difficulty. Its resistance to shock and abuse is termed high The new planes will be powered with Wasp engines and will be equipped for catapulting

Planes with Monel metal pontoons have already been tried by the U. S. Navy with satisfactory results especially for service in tropical waters. In weight the new floats and pontoons will not exceed by 10 per cent those of aluminum alloy it is declared

Smithsonian Gets "?" Engine

WASHINGTON (D. C.)—One of the Whirlwind engines used in the Question Mark plane is to be exhibited in the United States National Museum here by the Smithsonian Institution following the Secretary of War's compliance with a request of Dr C G. Abbot secretary of the Institution.

National Insurance Association Organized

ATLANTIC CITY (MO.)—A national association of insurance men interested in aircraft insurance was formed at Atlantic City recently with William A. Osgood, aircraft insurance underwriter of Kansas City as president The Association will be known by the name of Aviation Assurance Agents of America It will have as its purpose the furnishing of insurance on aircraft through a national organization of insurance men located at strategical points The members of this association are established insurance men having offices in the various cities The association will place all insurance written in the Independence Companies of Philadelphia through the Barber & Baldwin organization of New York aircraft engineers and aircraft underwriters The Independence Companies were the first companies to write aviation insurance

The Association has at the present representation in the following cities Baltimore Md., St. Louis, Mo., Gloversville N Y, Rochester, N Y Oklahoma City Okla., Kansas City, Mo, Los Angeles Calif., Minneapolis, Minn Toledo Ohio, Phoenix, Ariz., Milwaukee Wis. San Francisco, Calif. Buffalo N. Y. New Orleans, La., Topeka, Kan Cleveland Ohio, Chicago, Ill

Representatives Named

RUSSELL PARACHUTE — Robertson Division Universal Aviation Corporation

AVIATION ACCESSORIES CORPORATION —Aero Corporation of California, for Southern California Arizona New Mexico and El Paso, Tex

LEBLOND—Aero Corporation of California for Southern California Arizona, New Mexico and Texas

MAHONEY-RYAN — Montgomery School of Aeronautics of Montgomery, Ala

TRAVEL AIR—Tate Motor Company, St Louis Mo

AVIAN—Allentown Aviation Corp., Allentown, Pa Ludington-Philadelphia Flying Service, Philadelphia, Pa.

FLEET—D W Flying Service, Donald Woodward Airport, Le Roy, N. Y

BARLING NB3—General Aviation Company Syracuse, N. Y., for the State of New York

STANDARD STEEL PROPELLER—Air Associates 535 Fifth Ave., New York, N Y

ARROW SPORT—Paul Eidsmore for Washington and Oregon

Concerning Bradley Caption

In our issue of June 8, Samuel S Bradley is incorrectly captioned in a picture as president of the Manufacturers' Aircraft Association The title should have read General Manager

Kansas Tour Underway

WICHITA (KAN.)—Delayed because of the destruction of several tour planes in the recent heavy windstorm here, the second annual All-Kansas Air Tour did not get underway here until June 4 More than a score of planes took off for the state trip slated to end June 15

N.A.T. Tests Automatic Pilot Device on Douglas

CHICAGO (ILL.)—The Guardianair aerodynamic automatic control, of the Greene Patents Syndicate, Elyria, Ohio has been declared successfully tested here by National Air Transport, Inc. employing a Douglas mail and express plane for the trials The device, it will be recalled, was exhibited at the Detroit show

E P Lott, N A T operations manager who flew the plane, is reported to have found the control most satisfactory in keeping the craft in proper flying position Officials, furthermore believe there are fine possibilities in the device for bad weather flying

The Guardianair apparatus controls the plane by means of a vane supported on the upper wing of the machine and pointing ahead into the air stream A pendulum extends from the interior of the fuselage and both vane and pendulum are connected to a control device actuating two motors, one of which controls the elevators and the other the ailerons Side or forward motion of the plane causes a movement of vane and pendulum which through the control motors bring the plane to a stable position The pilot need only operate the rudder, it is said In this way, the round-about method of the pilot watching the instruments, then operating the controls accordingly is done away with for the automatic device, it is said cares for this vigilance by keeping the plane in stable position

Kinner Base for Wichita

WICHITA (KAN.)—L B Jeffries, industrial commissioner of the Wichita Chamber of Commerce announces that plans have been completed for location here of a service branch of the Kinner Airplane & Motor Company, Glendale Calif The branch will be in operation before the end of the present month he says Later a factory branch will be opened Several Wichita aircraft companies are using the Kinner company engines

Oildraulic Sales Increase

DETROIT (MICH.)—Aircraft Products Corporation, this city, reports a great increase in business. Plans call for a production program of 500 of the firm's Oildraulic shock absorbers each month beginning with July A company statement says 42 firms have used these absorbers with 22 adopting them as standard equipment

Materials Committee Meets at Washington

WASHINGTON (D. C.)—The Committee of Materials for Aircraft formed by the N A C A from prominent materials men throughout the country, met in Washington on June 6 under the chairmanship of Dr G K. Burgess, director of the Bureau of Standards, to discuss new developments and make research plans for the coming year Reports were received from subcommittees on metals woods, glues, coverings dopes and protective coatings, and aircraft structure Programs for future investigations are quite elaborate

Further studies of the corrosion of duralumin and other aluminum alloys were recommended by the committee It has been found that the Coco Solo Station in the Canal Zone gives conditions which produce the most accelerated corrosion known Accordingly, several thousand different types of alloys with different heat treatments and protective coatings have been sent there for trial The samples are in the form of finished test specimens so that on return a breaking test will show immediately the losses in strength and elongation, giving a measure of the corrosive attack A large part of the work already has been reported in N.A.C.A Technical Notes Nos *282 283 284 285*, and 304 A further paper is in preparation.

Developing New Coatings

From these reports the committee is convinced that the protection of duralumin from corrosion by means of pure aluminum coatings such as are used in Alclad is sufficient to justify entire confidence The committee also believes that other coatings are proving satisfactory and that still better protective treatments are in development It is generally felt that the protection given to duralumin is superior to that given to ferrous metals

Work is being continued on the resistance of duralumin both plain and Alclad, and of magnesium to flexure and fatigue. Tests are being made at the Bureau of Standards on thin sheet forms in connection with new all-metal construction which is coming into use for airplanes The committee also recommends studies of corrosion resistant steels for streamline wires

Miami Club Open to Members

MIAMI (FLA.)—Members of flight squadron No. 1, Miami Aero Club, recently voted to open the squadron to new members at $100 each, including in this an interest in the training planes and pilot instruction The club has 53 members

To Open Boeing School Sept. 1

SEATTLE (WASH.)—The Boeing System announces that it will start Sept. 1 the first of what will be a series of flying schools at strategically located cities

PERSONNEL

H L. Balderston, formerly of the American Paulin System, Inc, Los Angeles, has been placed in charge of organizing dealers, distributors and special service stations for the Pioneer Instrument Company.

James H Steenson has been appointed sales engineer of General Airplanes Corporation of Buffalo, N Y.

William F Centner, of the Aeronautics Branch, has been appointed superintendent of Port Columbus Municipal Airport.

L. G Hubble has been appointed field manager at the Port of Portland, Ore., Airport.

Glen Biddle has been selected student instructor for Dakota Airlines at Renner Field, Sioux Falls, Ia.

J Lansing Callan has been elected general manager, vice-president and director of the United States Air Express and a director of the Seaplane and Amphibian Flying School of Long Island Clifton Webster has been elected vice-president and general manager of the school.

R. Todd Crutchfield has been named regional sales manager for the Garland Aircraft Company with headquarters at Dallas, Tex.

Daniel Corcoran, Jr., has become traffic agent at Tulsa for the Braniff Airlines.

"Red" Harrigan will become personal pilot for William G McAdoo, former secretary of the treasury.

Wilson Barron, formerly salesman with the Robertson division of Universal Aviation Schools, has been made sales manager for the Universal school at Cleveland.

W. R. Duck, of the Elliott & Duck Flying School at Oakland Airport, is Oakland representative for the Western Auto Company's aviation department.

L. L. Wassenberg, of Lincoln, Neb., a former flying school instructor, has been engaged as a pilot on Universal's St Louis-Kansas City-Omaha mail and passenger route.

Gordon K Hood, formerly manager of the Syracuse, N Y, Airport has resigned to devote his entire time to the Syracuse branch of the Curtiss Flying Service.

S. H. Phillips, Cardington, England, formerly production manager for the British Air Ministry in the construction of dirigibles, has joined the technical staff of the Goodyear-Zeppelin Corporation, Akron, Ohio. He assisted in the construction of the Shenandoah.

Lieut. Cornelius W Couseland, formerly of Fort Sill, has resigned from the Air Corps to become a pilot on the Braniff Oklahoma City-Tulsa run. Capt Claude F Gilchrest and G. E. Warren have been added to the Braniff pilot staff also.

W. P. McFail has been appointed a director of the Robertson Division of Universal Aviation Schools to succeed Paul E. Gillespie now president of the Robertson Aircraft Corporation.

Capt. H. C. French has been elected president of the Aero Club of Oregon, Portland, chapter of the N A A. Vance Breese is vice-president.

Edward C. Wilcox, of New York City, will represent the Curtiss Flying service in Wichita.

James Lovell, formerly correspondent for Aviation and connected with the editorial department of the *Times-Herald*, became traffic manager at Fort Worth, Tex., for the S.A.F.E. lines on June 3.

I. W. Galehousen, has been appointed western representative of the American Eagle with headquarters at the Oakland Airport.

H. F. Andrews, formerly with the Capitol Air Lines between San Francisco and Sacramento, Felix Preeg and Tex Marley, Navy fliers, and Milo Campbell, commercial pilot, of Oakland, recently have been added to the staff of the Maddux Air Lines, Los Angeles, Calif.

Arwin W. Sommer has been elected president of the Sheboygan Airways, Inc., Sheboygan, Wisconsin. Otto Kaufmann, Jr., is vice-president, Miss Ione Shaw, secretary, Mrs Hildegard Sommer, treasurer, and John Cesar, director.

Capt. William E. Kepner of the Air Corps, a veteran balloonist, has been assigned to the Material Division at Wright Field, Dayton, Ohio.

Si Morehouse, formerly chief pilot on the Los Angeles-San Francisco line of Western Air Express, has been made chief pilot of all the company's lines.

Theodore Hubbell has been appointed traffic manager in charge of air mail operations of the Embry-Riddle Company, Cincinnati, Ohio.

William B. Mayo, chief engineer of the Ford Motor Company, has been appointed by Gov. Fred W Green, as chairman of the State Board of Aeronautics created during the last session of the legislature to supervise airports, planes, and pilots in Michigan. The board includes besides Mr Mayo, Col. Edward V. Rickenbacker, Claude Carney, of Kalamazoo, Harry Fletcher, of Cheboygan, and Frank L. Betts, of Menominee.

F. H. Langeway is now northwest inspector for the Aeronautics Branch with headquarters in Minneapolis. George Gardner, former inspector in this district, is now school inspector with headquarters in Chicago.

F. K. Buckalew is superintendent of the new Linde Air Products oxygen plant at Oklahoma City. A. B. Curtis is district superintendent with headquarters at Dallas.

Wayne C. Williams has been appointed pilot by Universal Aviation Corporation. Ensign Ross F. Mahacheck, instructor in the Robertson school, Louis Wertheimer, H. S. Halle, Rudolph Zurowesti and Ray Mote, salesmen for Robertson school.

Lieut.-Comdr. J. R. Peterson, Jr., has been appointed acting commandant of the Key West Naval Air Station following the retirement of Capt. Robert W. McNeely.

U. N. Howell, manager and treasurer of the Eagle Stove Works, Rome, Ga., has been elected president of the Rome Airport Corporation which has increased its capital stock from $15,000 to $50,000, and will establish a modern airport west of Rome.

Ensign George Gilbertson has been engaged as instructor in navigation, meteorology and theory of flight for the St. Paul branch of Universal Aviation Schools.

Emil A Holmes will have charge of organizing new groups for the American Society for Promotion of Aviation in the Northwest with headquarters in Minneapolis and St. Paul.

George Fitzhenry, formerly of the Mohawk Aircraft Corporation, is supervisor of all welding classes in the northwest division of Universal Aviation Schools.

Ralph Rugh, of St. Louis, has been appointed chief photographer for the Universal Aviation Corporation.

Benjamin Badgeley is president of the newly formed Los Angeles City Engineers Flying Club.

Edward Hefley, formerly instructor at the Rapid Air Lines School in Huron, S. D., is now pilot on the Huron-Rapid City mail line. He has been succeeded by R. N. Williams.

Roy O. Hunt, former manager of the Grahamn Flying Service, Norman, Okla., branch, has been placed in charge of the field and school at Enid, Okla. R. V. Carleton replaces Hunt at Norman.

Burt Ison has been appointed assistant to Paul Goldsborough, vice president in charge of operations of the Universal Aviation Corporation.

D. H. Cramer has joined the staff of the Guardian Air College in charge of production. Richard F. Harnin has been made chief engineer and Lieut. A. A. Yotz supervises all lecture classes.

Harold L. Debus, publicity manager in Denver for Western Air Express, is to be transferred to Los Angeles headquarters where he will operate as assistant to Fred Goodcell, publicity director of the organization. His successor has not been named.

Clifford D. Elliston has been made publicity director for the Garland Clevenger school at Tulsa, Okla.

C. A. Anderson has been appointed sales manager in Philadelphia of the Ford Chain Block Company.

Allan Gurley and Roy Clark will represent the Curtiss Flying Service in the vicinity of Potsdam, N. Y.

Clinton T. Johnson has been elected president of the Oklahoma City chapter of the N. A. A.

BRIEFLY

More than 130 exhibitors have signed for space at the aeronautical exposition to be held here in conjunction with the National Air Races, Clifford Henderson has announced.

A chute device for launching planes in a small area has been patented by C. Francis Jenkins, Washington, D. C., inventor.

S.A.F.E. has purchased five so-called Aero cars, designed by Eddie Rickenbacker several years ago for transporting passengers between hangars and fields on its lines. These trailers carry 14 passengers.

The Sullivan Company is building a three-place, Kinner-engined, all-metal plane and plans to have its first product ready for the air in early July.

Yellow Air Cab recently organized in Kansas is reported negotiating with the Curtiss Flying Service for a fleet of Cessna planes.

The government radio station near the new Wichita, Kan., Municipal Airport is nearing completion.

Walter S. Marvin, president of the Curtiss Airports Corp., is in Europe studying foreign airports.

A new helicopter design is reported being worked out at the Hamilton Metalplane Company's plant, Milwaukee Wis., by Jess C. Johnson of Delray Beach, Fla.

The Great Lakes Aircraft Corporation's training and sport plane has been pronounced aerodynamically sound by Prof. Alexander Klemin.

The first of the new Boeing sport planes modelled on the machine used by Captain Eaker on his flight to the Canal Zone has been completed for the use of Maj. Clarence M. Young of the Aeronautics Branch.

Through the June issue of *The Aeronautic Review*, the N A A. launches its national movement for the establishment of flying clubs.

New Jersey high schools have been presented with discarded planes and equipment of the New Standard Flying service for instruction purposes.

A monoplane powered with two Cyclones in tandem, has been flight tested at Wright Field. The machine was designed by Lieut. John A. Macready.

Atlas Diesel Engine Company, San Francisco, Calif., may manufacture diesel aircraft engines.

The Buffalo, N. Y., Municipal Airport was officially declared an airport of entry June 3.

Exports of American-built aircraft doubled in the first quarter this year over the same period last year.

The N A C.A. is starting development of a Diesel aircraft engine.

A Fokker biplane has been presented the Bergen County Police Air Unit by the Wright Aeronautical Corporation. The unit includes Major Pangborn, Capt. Hugh Wells and Lieuts. Leon Allen and Walter Jones.

Completion of twelve eighteen-passenger tri-engine Boeing transports is being rushed at the Boeing Seattle Seattle factory.

The fast time of 40 min. for the flight between Detroit and Cleveland was made June 1 by an amphibion of the Thompson Aeronautical Corporation.

The University of Buffalo will cooperate with Colonial Flying Services in the conduct of the Buffalo Flying School.

Contestants in the Second National Airplane Model League of America Contests at Detroit June 20-22 will be given a banquet at the large Ford hangar at Dearborn by Edsel Ford.

The Mitchel Field, L. I., radio beacon has been completed.

Snyder, Tex., with a population of 5000 is said to have one of the most modern airports in the Southwest.

Air Associates will open its new Chicago hangar June 15. The company has a contract for authorized Wright Aeronautical service overhaul and parts at the Chicago Municipal Airport, it is announced.

Waco Airport Company, Troy, Ohio, announce recent shipment of a carload of Wacos to Buffalo Aircraft Distributors. Shipment of plane parts amounting to several thousand dollars have been made, also, to Australia.

Coffman Monoplanes, Inc., have entered one or more of their Oklahoma City built ships in the Kansas State Air Tour.

Curtiss Flying Service is making plans for construction and lease of a separate field at Oklahoma City.

Oklahoma now has 125 cities and towns air marked.

The Commercial Aircraft Company has completed its new factory buildings at the Los Angeles Metropolitan Airport.

A grandstand seating 30,000 will be erected on Cleveland Municipal Airport for the 1929 National Air Races, August 24 to September 2.

G. MacLean Gardner, once with the General Airplanes Corporations of Buffalo and the Fokker Aircraft Company, states that he is looking for a site in Buffalo to build a new airplane factory.

A flying club has been organized at Manila, P. I., with 20 members of many different nationalities.

The hangar at Roosevelt Field formerly occupied by the Sikorsky Company, has been taken over by Air Associates.

With the recent completion of the $100,000 municipal airport at Lincoln, Neb., has three well developed fields.

Fokker Universal will be used by Paul Copeland, district sales manager for the Kellogg Sales Company, Denver, Colo., in making his calls in the entire Rocky Mountain section. Small shipments of Kellogg cereals will be carried.

The Schlee Brock Company, Detroit, has been appointed sole Lockheed representative.

The Monosport is the name of the new machine announced by the Mono Aircraft Corporation in Moline, Ill.

TRADE TIPS

It has been reported that

Syracuse, N. Y., is looking for a new airport manager.

Louis Hoppe, now taking a course with the Robertson division of Universal Aviation Schools, St Louis, Mo., intends to buy a plane upon finishing his course and use it for travel in visiting the chain of hosiery stores which he owns throughout Missouri.

An ordinance instructing the city clerk to advertise for bids on drainage materials and construction work for the new municipal airport has been passed by the Omaha, Neb., city council. William E. Arthur of the Austin Company, Cleveland, drew the plans.

Contracts for the proposed grading and drainage work at Lambert-St. Louis field for which $275,000 has been appropriated will be let June 18. Work must be started in ten days and completed by the middle of October.

Information about suitable engines and training planes for club use is being sought by T. T. Kelley of Coral Gables, Fla. Robert Habig and Arthur E. Curtis of the Miami Aero Club, Miami, Fla.

The Paramount Aircraft Company of Saginaw, Mich., is trying to locate a responsible agent at Lincoln, Neb., as a preliminary move toward making that city a distributing point for the Cabinaire plane in that section of the country.

H. B. Taylor, 4436 Pershing Street, Fort Worth, Tex., has given out a statement saying that his company will make large expenditures for development, in Mobile, Ala., Montgomery, Ala., Atlanta, Ga., New Orleans, La., and El Paso, Big Springs, Amarillo, Fort Worth, Dallas, Waco, San Antonio, Houston and Brownsville, Tex.

The Omaha, Neb., city council has returned unopened all bids for draining the municipal airport. Present plans will be supplemented by the city engineer and the call for bids readvertised.

Errol H. Come, 157 King Street, Sydney, Australia, wishes information concerning American aircraft developments.

Pheasant Aircraft Company, Fond Du Lac, Mich., is planning to place additional territorial franchises.

The Desoutter Aircraft Company, Croydon, London, S.W., builder of Dolphin three place cabin plane, is anxious to dispose of American manufacturing rights.

Space for manufacturers of airport accessories is being provided in a large aviation building to be constructed on 33d Street, Los Angeles, Calif.

AIRPORTS AND AIRLINES

Two Companies Start Air-Rail Lines

S.A.F.E. and Aviation Corporation in Projects

NEW YORK (N. Y.)—Transcontinental air-rail passenger service, requiring but three nights and two business days of travel, will be inaugurated June 15 by The Aviation Corporation through its subsidiary, Universal Aviation Corporation, and in conjunction with the New York Central and Atchison, Topeka and Santa Fe Railroads, it has been announced.

Only one day of flying is involved, plane service being supplied by Universal Air Express, a Universal subsidiary, on the 1,087-mi. daylight Great Circle route between Cleveland and Garden City, Kan., in the extreme southwestern part of the state Tri-engined 12-passenger Fokkers will be used in the new service

Meals at Stops

The westbound schedule will operate as follows Passengers will leave New York or Boston in the early evening and reach Cleveland on the New York Central's Southwestern express, go by plane to Garden City, with stops at Chicago and Kansas City for luncheon and refreshments, arriving at Garden City the evening of the second day The second night, the next day, and the third night will be spent on the California Limited of the Santa Fe Railroad, arriving at Los Angeles and San Diego on the morning of the third day

Eastbound passengers will leave Los Angeles at 12 30 p.m. on the Santa Fe's Grand Canyon Limited, arriving at Garden City on the second morning, then go by plane to Cleveland that day and arrive in New York at 9 50 a.m. on the third morning

Passengers may use the Twentieth Century Limited both eastbound and westbound, connecting with the planes at Chicago. One of the features of the system will be the feeder lines provided by the Universal's Braniff and Robertson routes already in operation through the Mid-West. Railroads north and south also will make connections with this service.

Details Withheld

The Aviation Corporation officials explained that announcement of this scheme had been held until all details had been ironed out The preliminary work included very careful and extensive surveys of all conditions before a final selection was made Government weather service serves the route. The fare will be about $250 The schedule announced will be as follows:

Westbound Read down (E.S.T.)		New York Central		Eastbound Read up (E.S.T.)
1st Day	3 00 p.m. lv	N Y ar	9 50 a.m.	4th Day
	2 10 p.m. lv	Bost. ar	12 35 p.m.	
	6.05 a.m. ar	Clev lv	9 00 p.m.	
		Universal Air Express		
	7 10 a.m. lv	Clev ar	7:43 p.m.	
	(C.S.T.)		(C.S.T.)	
	9:03 a.m. ar	Chi. lv	4 00 p.m.	
	9 45 a.m. lv	Chi. ar	3 53 p.m.	
	1 50 p.m. ar	Kan. City lv	12 18 p.m.	
2nd Day	2 30 p.m. lv	Kan City ar	11 40 a.m.	3rd Day
	(M.S.T.)		(M.S.T.)	
	3 20 p.m. ar	Gar City lv	8 10 a.m.	
		Atchison, Topeka & Santa Fe		
	6 10 p.m. lv	Gar City ar	7:53 a.m.	
	(P.S.T.)		(P.S.T.)	
4th Day	9.15 a.m. ar	L.Ang lv	12 30 p.m.	1st Day
	12 45 p.m. ar	San Diego lv	9.00 a.m.	

S.A.F.E. Plans Revealed

An air-rail arrangement expected to cut the time for coast-to-coast travel to two days will be put in operation June 15, it has been announced through Frank Phares, division traffic manager of the Southwest Air Fast Express. This company has promoted the line in conjunction with the New York Central Lines and the Texas & Pacific Railway

Passengers may leave New York City at 1 p. m., it is said, by train and reach Indianapolis in the morning. Planes will carry them to Sweetwater, Tex., where they will entrain for El Paso. The trip will be continued from there by plane the next morning, arriving at Los Angeles in the afternoon. The flights will be made in daylight and the two nights will be spent on the train

The trip will require about 48 hr. Tri-engined planes will be used The return trip will be made in the reverse manner of the west bound trip, Complete information about the project has not been announced yet but it is known that the S.A.F.E. system under the leadership of Earl P Halliburton, president, has been working on the idea

Continental Starts New Passenger Line

LOUISVILLE (KY.)—A new airplane passenger service between Louisville and Cleveland has just gone into operation by Universal A seven passenger monoplane will make a daily flight each way

The Cleveland plane will leave Cleveland at 1 p.m. arrive at Columbus at 2 30, and Cincinnati at 3:30, Eastern Time. The plane will arrive at Bowman Field Louisville, at 3 20, Central Time The Louisville plane will leave 11 30 in the morning, Central Time, and arrive at Cleveland at 3·35 in the afternoon, Eastern Time

Cities Work Hard To Get Mail Lines

WASHINGTON (D. C.)—Vigorous appeals for air mail service from a large number of widely separated cities have resulted from the hearings of the Interdepartmental Committee on Airways, recently set up There appears to be no lack of vision of what air mail service can mean to a community and apparently no steps are being omitted to secure these advantages

The most recent hearing was held Wednesday, June 12, and, as AVIATION goes to press, those interested in the two airways projects are preparing to make strong cases for their points of view The routes involved are the proposed Louisville-Dallas air mail service and the proposed establishment of an Atlanta-Dallas-Fort Worth route.

Straightening of the present Atlanta-New Orleans route to run through Montgomery, Ala, instead of Birmingham, and the placing of the latter on the proposed Atlanta-Dallas-Fort Worth line, also will be considered

St. Louis Anxious

St Louis interests are very anxious to have adopted the Louisville-Dallas-Fort Worth airway with a connection with St. Louis Representatives of civic and commercial organizations from Cleveland, Akron Columbus, Springfield Dayton Cincinnati, Louisville and Memphis met at Louisville June 7, to prepare data to present before committee on the proposed Louisville-Dallas air mail route.

The Southern Airways Association opposes inclusion of Atlanta on the southern trunk airway, claiming the association's choice, which includes Washington, Raleigh, Columbia, Augusta, Macon, Dallas and Fort Worth, would serve the most population. Birmingham made extensive preparation for a fight for its position in the ultimate picture.

Meanwhile, it was reported that as an outcome of the May hearings, the committee had recommended that bids be invited for an air mail route linking Seattle Portland and Spokane directly with Salt Lake City This awaits approval of the postmaster general and the secretary of commerce It was recommended that the Varney service be extended through one line to Seattle and another to Spokane, with Pasco as a base.

T.A.T. Drills Passenger Agents

ST LOUIS (MO.)—Twenty passenger agents have reported at headquarters of Transcontinental Air Transport here for training prior to the opening of the coast-to-coast air-rail service July 8.

T.A.T. Pilot Staff Prepares For New Line

ST. LOUIS (MO.)—Thirty four T.A.T. pilots were here recently preparing for the "dress rehearsal" flights of the line which will start about June 24, two weeks before actual operations begin July 8.

The pilot personnel is announced by Paul F Collins, general superintendent, as follows Eastern division H W McGee, D W Buford, H. J Zimmerman and G C Price, living at Columbus, S D. Welsh, H. H. Gallup, F V Tompkins, Ambrose Banks Ben O Howard, Joseph S Battles, Clifford V Abbott, Harry E Campbell, N A. Laurenzana, and Otis F. Bryan, living at St. Louis; Earl W. Fleet, Carl W Rach, Fred G Richards and Howard E. Hall, living at Waynoka, Okla.

Western Division Lester D Munger T R. Howe, J. B. Stowe, Jesse E Hart V R. Lucas Edwin A. Diebel, Morley F. Slaght and W. G. Davis, living at Clovis, N Mex., Edward A Bellande, Stephen R. Shore John Guglielmetti Moye W Stephens, H. B Hoy, Noble G Hueter, William Campbell and Wesley F Phillipi, living at Los Angeles

Although the line is divided into only two divisions each pilot will fly just half of each division Pilot crews will be changed at St Louis, Waynoka, Okla. and Winslow, Ariz.

Newark Reports Finances of Airport

NEWARK (N J)—A deficit of $3,965.08 has been reported for the seven months of operation of the local airport ending April 30 according to Chief Engineer Costello It is expected that revenue will increase during the forthcoming months while the operating and maintenance expenses are expected to remain about constant.

Income for the period named was $19 541 49 and the operating expenses, $23,506 57 The income was from the following sources Leases $2 258 30 hangar storage $7,290.70, 10 per cent tax on passenger flights, $6 055 85; automobile parking, $2,960.24, and other receipts from mail companies, $996 64.

Expenses have increased as follows October, $220 65 November. $1,218 90 December $1,218 94 January $2-682 31 February, $5,224.87 March, $7,274 52 and April, $5,666 38

From January on the amounts include the salary of Lieut Richard Aldworth, airport manager who assumed charge that month at an annual salary of $10,000

Curtiss Adds New York Site

NEW YORK (N Y)—Curtiss Airports Corporation has announced plans for a $3,000 000 land and sea plane airport of the unit in its nation-wide chain. The site comprises about 250 acres in the Bronx section of the city adjoining Pelham Bay Park

Approve Night Passenger Route

SALT LAKE CITY (UTAH)—Night passenger flying is feasible according to officials of the Boeing system, following the completion of the first month's operation of tri engined twelve-passenger transports on the 643-mile hop from here to Oakland

The machines leave Oakland at 8 p m and leave Salt Lake City at 9 p m The Oakland plane arrives in Salt Lake City at 2 30 a m and the west bound plane arrives at Oakland at 4 30 a m This section includes the recently opened beacon system which completed the lighting of the transcontinental airway

Varney Air Lines Formed in California

SAN FRANCISCO (CALIF)—Announcement has been made of the formation of Varney Air Lines Inc. which will take over the physical assets and operation of the Pasco-Salt Lake mail route and associated enterprises of Walter T Varney a pioneer in aviation. It also became known in connection with the transaction that the investment banking firm of Bond, Goodwin & Tucker and Aviation Corporation of California had acquired a substantial interest in the new company

L. F. Mueller, wartime pilot and ex-army instructor, who has been associated with Varney interests for the past ten years has resigned his post as secretary and treasurer of Associated Insurance Fund, Inc, effective July 1, to head Varney Air Lines Inc Mr Mueller will be president of the new company and Mr Varney will be chairman of the board Leon D. Cuddeback will be vice-president in charge of flying operations Nion R Tucker and Thomas B Eastland, of the banking house, will be vice-presidents.

Writ Halts New Orleans Work

NEW ORLEANS (LA)—A writ issued by the Louisiana Supreme Court, seeking to prevent an agreement between the Orleans Levee Board and the Orleans Dredging Company, has resulted in the suspension of all work on the new lake-shore municipal airport and the latest delay in the project. The writ was issued at the request of owners of camps and other property near the site, who assert that the Levee Board failed to give them sufficient notice for removal before construction work was to begin. Lower courts have refused to ratify the writ against construction which was recently approved by the War Department

Chicago-New Orleans Service to Be Opened

WICHITA (KAN)—Organization of a new passenger, express and air mail route from Chicago to New Orleans which is scheduled to start operation on September 1, has been announced here. Of the nine men interested in the new line six are of Wichita.

Five Wasp-powered Travel Air cabin monoplanes, will constitute the original equipment with which the line will open Those behind the project are Walter Beech, J. H Turner, Ray Brown, W M Moore, Marcellus M Murdock and Tom Johnson of Wichita, Maj Merrill D Mann, head of Continental Air Services, Inc, Chicago, and C. E Anderson and H B. Holst of the Grigsby Grunow Radio Company, of Chicago

The new line will run from Chicago to New Orleans by way of St. Louis, Cairo Ill Memphis, Tenn, Jackson, Miss, and Houston, Tex., connecting at all the southern terminals with Texas Air Transport.

The company was organized on a capitalization of $100,000 and an application is now pending in Illinois to authorize capitalization $1,000,000 Some of the largest banking interests in Chicago, it is reported, are behind the increased financing and will complete the financial structure of the new company.

On the board of directors are Major Mann, Anderson, Holst, Beech and Brown Beech and Brown are on the technical committee and Beech will be the active technical advisor for operations All the flying personnel has been picked, it is said All planes are to be delivered to the company officials at Chicago by August 15 The pilots will spend two weeks in flying the line and familiarizing themselves with the terrain before service opens

Expect 40 Planes In Second Iowa Tour

DES MOINES (IA.)—Seventeen cities are included in itinerary of the second annual air tour, June 24-29, under auspices of the Iowa Aeronautical Association, of which George Yates is president Forty planes will participate in the tour including a three-plane flying circus from the Livingston field at Waterloo Other planes and pilots may be entered up to the time of the take off of the first plane June 24 Races are limited to Iowa pilots but any other plane is invited to accompany the tour. The race events will include a free-for-all and a class limited to light planes of 90 hp

Cities included in the itinerary are June 24, Des Moines, Centerville and Ottumwa June 25, Muscatine, Iowa City, Marshalltown and Waterloo; June 26 Fort Dodge; June 27, Mason City Emmetsburg Algona and Sioux City June 28 Shenandoah, Clarinda and Bedford, June 29, Atlantic, Creston and back to Des Moines

Report Additional Airport Construction

Development Work Continues in Many Places

Improvements totaling $500,000 are to be made on the new Myron T. Herrick Airport now under construction at Cleveland by the Curtiss Flying Services, Louis G. Meister, manager, reports The new field will be dedicated to the late Ambassador to France during the National Air Races.

Embodying a Colonial type of architecture, buildings on the field will be constructed in two units forming a semicircle They are designed by Kenneth Franzheim Stone & Webster are the supervising engineers

There will be 10 buildings on the field when completed. Work on the first two structures has started The administration building and a hangar for school use are the first two buildings to go up.

The eastern section of the 225-acre field is being reserved for future construction of an Aviation Country Club and golf course. Work has started on laying 400,000 ft. of tile drainage on the field.

Cleveland to Have Fence

A 3,600-ft. fence extending from the south to north entrances of the Cleveland Municipal Airport is to be constructed immediately, according to Maj John Berry This will prevent people from parking autos about the hangars and driving in front of the airport buildings There will be four entrances to the field for pedestrians.

Oklahoma City, Okla., on June 25 will vote on a bond issue providing $425,000 for improvement of the municipal airport. Purchase of an additional 200 acres for about $58 000 is included Other expenditures are as follows Purchase of present buildings $25 000, terminal building $90,000, night lighting $37,000, taxi strips and runways $29,250, weather instruments $500, radio $500, fuel system $3,000, radio building $2,000 first aid and medical equipment $2,500, fire fighting equipment $4,000 and grading $22 500

Roads and driveways will cost $4,000, furniture and fixtures $6000, obstruction painting $1,000 fencing $6 000, maintenance of equipment $2,800 engineering fees and incidentals $15,450, and water main extensions $10,000

About four and a half more acres are being added to the Vancouver, Wash., Municipal Airport which gives a total of 45 acres, which, combined with the Pearson Military Field of 86 acres, makes a suitable airport

Eagle River, Wis, has voted to lease a plot of land of 100 acres for airport development Work will be started soon Southern Air Transport, Inc., is continuing its investigation for a suitable airport base at Houston, Tex A large amount of money will be spent on the site selected.

St. Marys College, St. Marys, Kan, recently dedicated a 20-acre field north of the college and claims it is the first airport in the country owned and maintained by an educational institution

Syracuse, N. Y., has authorized $52,697 50 for the acquisition of the municipal airport at Amboy. The city has been operating this field for three years under a lease.

Colonial Western Airways, Inc, and the Curtiss Flying Service were the successful bidders for space at the Syracuse Airport at a public auction on March 21

Consider Fire Repair

Considerable debate has featured efforts to secure repair of the fire damage to the Rochester, N. Y., airport. About all the equipment on the field was destroyed by the disaster

With applicants for about 40,000 sq ft. of additional hangar space at Mills Field. San Francisco, the airport managers are going ahead with the construction of four new hangars from the sum of $160,000 recently made available for airport expansion. Grading of the field also is included in this.

Construction of hangars was to be started by June 15 at Akron, Ohio, Municipal Airport following the clearing away of red tape which has caused a year's delay to the commercial companies Air Services, Inc, will build a $60,000 structure which will include hangar space, shops, office rooms, flying school headquarters and two observation towers The B F Goodrich Company also has acquired a site and the Firestone Tire & Rubber Company has applied

The Akron hangars will be located across the present Akron-Massillon Road which will be abandoned for a new one built around the hill The old pavement will be used as a runway for planes. The hill is to be leveled at the top and a park established on the summit, commanding an excellent view of the airport

Abilene, Tex., has voted a $100,000 bond issue to provide an airport which is to be designed and constructed under the supervision of B. Russell Shaw & Company of St Louis

"Sky Harbor" About Ready

Hangar and office buildings at "Sky Harbor" the new airport for Scenic Airways at Phoenix, Ariz., has been completed and installation of lights is about finished. The equipment is identical in design with that of the El Paso, Tex., headquarters, plans for both having been drawn by the Austin Company. The 110x120 ft hangar has a 20x60 ft one-story extension in front for office and other accommodations It is designed for 100 ft. clear openings on each side, with doors of Detroit Steel Products manufacture.

Exterior walls are of brick, while the exterior side of the brickwork is covered with a waterproof cement The windows are of Bestolite glass in metal sash The heavy duty monolithic cement floors are approached by a 20-ft concrete ramp The plan for future extension of present buildings will include a 300-ft. clear opening without obstructing columns and with sliding-door arrangement. The beacon is Crouse-Hinds product.

Curtiss Flying Service, Inc, is said to be planning an expenditure of about $250,000 in the establishment of an airport at Jacksonville, Fla.

A 90-acre tract of land has been leased for five years at Beeson, Tex., on the Houston-Brownsville route. Work on the field will begin soon after September 1

Federal approval for the proposed site of the Brunswick, Ga., Airport has been received, and work will be rushed.

Progress is reported on the new seaplane base which the Fairchild Aviation Corporation is building at Amityville, L. I.

Improvements in the lighting are to be undertaken at the Newark, N. J., Airport The K. W. Electric Company was given the contract for the installation which will cost $60,678. Another cluster of Westinghouse floodlights will be added, making a total of four units. Another B B T light, the second at the field, will be secured. Chris McCann has been awarded a contract to build a metal and glass hangar at the airport for Colonial Airways System to cost $67,200. The city will receive 7 per cent of the cost for annual rental

R. I. Seeking Site

Rhode Island is to make a choice about a big airport development by August 1, according to the State Airport Commission. Some discussion has developed from the suggestion that $15,000 be paid to B. Russell Shaw, Phil Love and Preston Sultan for their advice relative to the improvements at Lambert-St. Louis airport.

The Roy Morris Aviation Corporation, Topeka, Kan., has awarded the contract for construction of 100x100 ft hangar at the Topeka Airport, to cost $20,000. The contract has been let for construction of a hangar at a cost of $11,800, at Woodward Field, near Camden, S. D. The Stearman Aircraft Company has let the contract for construction of a $36 000 hangar at the Municipal Airport in Wichita, Kan. The Midwest Aviation Corporation has let the contract for construction of $14,000 hangar at the Municipal Air Field of Omaha, Neb The Metropolitan Development Syndicate has awarded the contract for construction of a factory building on the corner of Woodley Ave and Lindbergh Drive, Metropolitan Airport, Los Angeles, Cal

P.A.A. Officials Inspect Lines

MIAMI (FLA)—As part of the race to establish air service between this country and Buenos Aires and Rio de Janeiro along the east coast of South America, officials of Pan American Airways recently left here for an 11,000-mile inspection flight along the Pan American routes.

Wind Wrecks Planes At Wichita Airports

WICHITA (KAN)—This city suffered its first airport damage of any consequence recently when a terrific windstorm swept the East Central and Swallow Airports causing damage conservatively estimated at $300 000 Private hangars and airplanes valued at $240,000 were destroyed at the East Central field and Swallow suffered a loss of about $60,000

A tri engined Western Air Express Fokker, which had landed just five minutes before the storm was demolished. Only the engines offer much in the way of salvage, it is said. The plane making its second flight on the Kansas City-Los Angeles run, was valued at $75 000 The Stanolind II tri-engined all-metal Ford plane was damaged to the extent of $50 000 It will be rebuilt at the Ford factory Stearman Aircraft Company's new Cyclone-engined combination mail and passenger plane, valued at $25 000 was wrecked, although company officials say it can be rebuilt The storm struck soon after the machine had landed from its first test flight

Other planes wrecked or damaged badly were eight Swallows, an American Eagle biplane, a Coffman high wing monoplane, three Travel Air biplanes and a Jenny

Despite the big loss at the airport only one person was injured Bob Lander attempting to protect the engines of the Fokker plane was hurled about 150 ft His injuries were not critical

N.A.T. and Newark Agree

NEWARK (N J)—With the reported acceptance of the local demand for a payment of $.01 per lb up to and including the first 1 500 lb of air mail and a half cent per lb thereafter, the long standing dispute between officials of this city and of the N A T is declared closed N A T will probably start using the local airport instead of Hadley Field with Colonial Airways System and Pitcairn Aviation It is expected that the city will build a hangar for N.A.T and charge 7 per cent of the cost annual rental

Call Ohio Ports Public Utility

COLUMBUS (OHIO) — Airports are public utilities and as such every legislative step in their development is subject to a referendum vote according to a decision of the Ohio Supreme Court, rendered June 5 The decision was reached in granting a mandamus order compelling the Canton City Council to call a special election and submit acquisition of the proposed site for an airport to a vote of the people

Ten to Share Big Ticket Office

CHICAGO (ILL)—Ten air line companies have signed contracts and leases for the largest consolidated air transportation ticket office in this country

Hobi Airways Starts Line

ABERDEEN (WASH)—Regular air transportation between Grays Harbor and Portland has been started by Hobi Airways Company, of Aberdeen and Eugene, Ore.

Braniff Announces New Line Schedules

OKLAHOMA CITY (OKLA)—Definite schedules for the recently launched Oklahoma-Kansas City service of the Braniff division, Universal airlines, has been announced Under the new service the former Tulsa-Bartlesville-Wichita route operated by Central Air Lines has been discontinued The schedules are

		Northbound	
Lv	Oklahoma City	7 00 a.m.	5 00 p m
Ar	Ponca City	8 20 a.m	5 50 p.m.
		Tulsa Connections	
Lv	Tulsa	7 00 p m	5 00 p m
Ar	Ponca City	8 15 a.m.	5 45 p m
Lv	Ponca City	8 20 a.m.	6 00 p m
Ar	Wichita	9 00 a.m	6 30 p m
Lv	Wichita	9 10 a.m.	
Ar	Kansas City	11 30 a.m.	
		Southbound	
Lv	Kansas City		3 10 p.m
Ar	Wichita		5 00 p m
Lv	Wichita	8 00 a.m.	5 10 p.m
Ar	Ponca City	8 40 a m	6 00 p.m

In addition to the schedules local service is offered by the line between Wichita and Kansas City daily

To Assist Seadrome Project

NEW YORK (N Y)—Black & Bigelow Inc, air transport engineers, have been retained by the Armstrong Seadrome Development Corporation to co-operate in the development of its mid ocean landing stage The seadrome was designed by E R Armstrong in co-operation with Henry J Gielow & Company, naval architects The principal constructors are the Sun Shipbuilding Corporation and the Belmont Iron Works of Chester, Pa Black & Bigelow will study the proposal to establish a test air line between this city and Bermuda, using the seadrome

Universal Adds Central's Lines

WICHITA (KAN)—Central Air Lines of this city, headed by E A. Watkins now is a division of Universal The new service was opened on June 2 Places served by Central Air Lines included Wichita Tulsa, Oklahoma City-Bartlesville Topeka and Kansas City The Central company originally operated planes between Wichita and Tulsa later extending the service to Kansas City and then to Oklahoma City

Savoia 55's For Commuters

NEW YORK (N Y)—Savoia-Marchetti S 55 flying boats will be used in a commuting service to be started between 96th Street here, and Southampton L. I., by Airvia Transportation Company This company plans a New York Boston service also with $30 fare for a one-way flight The S-55 machines will be used on this line also

Idaho Conference To Plan Co-Operation

BOISE (IDAHO)—Uniform and co-operative development of air commerce in eleven western states is the purpose of the conference of aeronautical interests to be held here July 8, 9 and 10 under the auspices of Gov H. C. Baldridge of this state Idaho, California, Oregon Washington, Nevada, Arizona, New Mexico, Utah Colorado, Wyoming and Montana will be represented

The conference will consider such items as how the state may most efficiently supplement government air commerce regulations and operations and state reciprocity relative to licensing of plane pilots Taxation is another important item Steps will be taken also to effect an organization of the eleven states into an association for the uniform development throughout that territory

Plans for this conference followed a preliminary meeting of representatives of such organizations as Boeing, W A E P A T, Varney, National Parks Airways and others in this city on April 8-19 This group endorsed the idea of a general conference. J D Wood, Idaho commissioner of public works, under whose jurisdiction aeronautics in Idaho have been placed has been in the East making contacts with various groups who may be represented.

It is expected that most of the governors of the eleven states will be present as well as officials and representatives of a large number of aeronautical organizations. The Army Navy, Post Office and Commerce Departments will be represented as well as the Interdepartmental Committee on Airways The speakers and their subjects will be announced soon

The conference has the co-operation of the Aeronautical Chamber of Commerce and many of the large national and eastern companies are interested

Hudson River Base Assigned

NEW YORK (N Y)—Commercial planes will have a Hudson River base at the foot of 135th Street according to a recent decision of the city, following prolonged discussion over denial of permission to use space at 79th Street and other suggested points This site is temporary and permits will be issued for one year only and in the meantime plans for a permanent base will be worked out Curtiss Flying Service, Coastal Airways and the Colonial Airways System are the three who are most interested in the arrangement

Pick-Up Test Miscarries

NEW YORK (N Y)—Plans to test pick-up of mail from the Leviathan on its arrival at this side recently miscarried The Burnelli-Chapman machine which was to have been used was damaged on the eve of the test and radio trouble prevented contact with the steamship after a Keystone Loening had been pressed into service

FOREIGN ACTIVITIES

Belgians and French To Fly Desert at Night

PARIS (FRANCE)—Following the return of the Farman survey plane over the route which the French and Belgian Governments propose to operate together across Africa to Madagascar, further plans about the project have been announced. It is said that a Belgian plane will leave Antwerp or Brussels for Beira in Portuguese East Africa on one week and a French plane will fly the alternate week between Paris and Madagascar by way of Beira, each alternating on the service.

The line will connect at Broken Hill in Africa with the proposed British Cape-to-Cairo line and also will make connections for Brazzaville and Stanleyville in the Belgian Congo. The route will call for crossing the Sahara Desert at night and lighting of this part of the route is being undertaken. At first it will be primarily a mail service, pas senger accommodations being provided later on.

38 Savoias on Big Cruise

MILAN (ITALY)—Thirty-eight flying boats have taken off from here on a cruise which will include Constantinople, the Black Sea, the Caspian Sea and return under the command of General Balbo, chief of military aviation in Italy, and General De Pinedo. Thirty-six of the flying boats are of the Savoia-Marchetti S-55 military type and two are of the S-55 commercial type. Duplicates of the machines have been sent to the American Aeronautical Corporation, Manhasset, L. I., and a similar one was used by De Pinedo on his famous 60,000-mi flight in 1926. During the cruise the planes will consume 1,800 gal of gasoline and 67 gal of oil each hour.

Study German School Accidents

LONDON (ENGLAND)—Accidents in German flying schools have attained such a frequency, it is reported, that the British aviation insurance group which controls German insurance through representatives has sent a mission to that country to investigate the situation, studying particularly the suitability of training planes used by the Germans, the operations of the schools and the methods of training employed.

China Plans Mail System

NANKING (CHINA)—Five projects to be undertaken soon for the establishment of an air mail system in China have been announced in the Chinese Economic Bulletin. Trunk and connecting air lines will link such centers as Tibet Canton, Mukden, Shanghai, Foochow

Recognize Neunhofer Record

PARIS (FRANCE)—The altitude mark of 41,795 ft. set by Willy Neunhofer, of Germany, has been officially homologated by the F.A.I. The previous record of 39,140 ft. set by Lieut Appollo Soucek, U.S.N., was homologated also

Foreign News Briefs

Dr. Hugo Eckener has been defending the cause of the airship in a reply to reported statements by Premier Mussolini tending to minimize the value of lighter-than-air craft

Curtiss Reid Aircraft Company, Ltd., of Montreal, Canada, has started construction of a seaplane base about three miles from its St Laurent plant.

Pan American Airways will start its air mail service from the Canal Zone touching Cartagena, Baranquilla and Curacao, Dutch West Indies, on the north coast of South American, on June 21

Petrovarden, Jugoslavia, is to have the second European parachute factory of the Irving Air Chute Company

Ben Brotman and Bruce Ronald, Winnipeg, Canada, pilots, have announced plans for an attempt to fly from Canada to England over the Greenland route starting about August 15

The Irish Free State is making progress with its plans for a daily air service between Dublin and London. Two other plans include a service between Cork, Limerick, Galway and Belfast and also to develop Cork as a base for a continental service to meet ocean liners for speedy transfer of mail and passengers. These planes would operate between Cork, Paris, Brussels and Berlin

Australia's new air service between Adelaide and Perth will start tomorrow, June 2. This will reduce the time required for the trip from four days by train to only two days

Northwestern Airways, Ltd., has been organized in Winnipeg to provide air service in Manitoba, Saskatchewan and Western Ontario

The Japan Air Transport of Osaka will operate a Junkers 13 seaplane between that city and Bettu across the Inland Sea

Belgium Seeks Air Uniformity

BRUSSELS (BELGIUM)—The Belgian Government is preparing a European convention, to be held here, in order to establish uniformity of air mail services between the various European traffic companies and shorten air mail transport accordingly, it being expected that by such uniformity it would take a letter only two days to be carried by air from London to Constantinople

Planes to Speed Medical Services

PARIS (FRANCE)—Serious development of provisions for air ambulances and transportation of doctors and medicines by air to an emergency call and to desolated points will be given by leading countries of the world as a result of the first Sanitary Aviation Congress held in this city last month. The delegates resolved to do all in their power to stimulate development of equipment and systems, both military and civil, to speed up medical service

Probably the greatest strides in this direction so far have been taken by the French, the Farman F-60 for instance, being an air ambulance capable of carrying six patients on stretchers with a doctor and nurse in attendance in addition to the crew of the plane, while another Farman is able to carry twelve persons seated or ten lying down.

Swedish Airmen Forced Down

REYKJAVIK (ICELAND)—A gasoline leak is reported to have been the cause of the forced landing of the Swedish trans-Atlantic plane Sverige at Skaptaros, 150 mi east of here, 2.56 a.m local time, June 10. The machine carrying Capt Albin Ahrenberg, pilot, Axel Floden, assistant pilot, and Robert Ljunglund, wireless operator, had covered about 1,250 mi of the trip. They left Stockholm at 6.03 a.m June 9, refueled at Bargen, Norway, and took off from there at 3.29 p.m. expecting to reach here by 11 p.m. (Repairs were being rushed as AVIATION goes to press and the flight was to be continued in stages by way of Greenland and Anticosti Island in the St. Lawrence River to New York City.—Ed.)

P.A.A. Gets New Mail Contracts

GUATEMALA CITY (GUATEMALA)—Pan American Airways and the Guatemala government have signed a temporary agreement for air mail service in this country. A similar agreement was closed with the Latin-American Aerial Transport. It is also reported here that P. A. A. and the Honduras government have signed an air mail contract good until January 31, 1931

Vancouver Airport Assured

VANCOUVER (B. C.)—Construction of a permanent airport at this city is now assured, as a bylaw for expenditure of $300,000 for this purpose has been voted. A further $100,000 will be contributed by the North Fraser Harbor Commissioners. Sums for general improvements at the city's temporary airport on Lulu Island have also been approved

THE BUYER'S LOG BOOK

Triumph Fuel Gage

THE Boston Auto Gage Co., Pittsfield, Mass., has entered the aircraft field with a complete line of "Triumph Magnetic Gages" for aircraft fuel and oil tanks. A large number of models are offered

The construction of these gages is such that there is no mechanical connection whatever between the float mechanism and the indicating pointer and even if the glass face is broken there is no possibility of leakage

The Model No 106 Boston gage (left) Installation diagram (right)

and consequent fire hazard. They are light in weight easily readable and can be furnished in reverse for reading in a mirror. Standard dials have a light colored background with black characters. Dark colored background with light characters also can be furnished. If luminous graduations are desired the dark background is used. Triumph gages are made up and installed as units, the only installation labor being that of screwing the gage into a flange

The model No 106 Fuel Gage is designed for center section wing tanks, side wing tanks (either high or low wing) or tanks in any location from which the dial can be read. This gage is of the flat head geared type and screws into a flange having a standard $1\frac{1}{2}$ in pipe thread. The dial face is $2\frac{1}{4}$ in in diameter. The distance from the face of the tank to the top of the standard flange is $\frac{5}{16}$ in. When using the standard flange the gage head projects $\frac{5}{8}$ in from the face of the tank. The weight of the gage for a tank 10 in deep is 10 oz. For other tanks the weight may be computed by adding or deducting $\frac{1}{2}$ oz for each 3 in variation in depth. The weight of the standard aluminum flange is 3 oz and of the standard composition flange is 9 oz

Workace Portable Saw

A PORTABLE saw, adaptable to a number of uses has been placed on the market by J. D. Wallace & Company, Chicago. It derives power from the ordinary lighting circuit or the power circuit, and may be furnished for direct or alternating current

This new machine, known as the "Workace Radial Saw," is easily adjusted to cut at any angle, for cross cutting or ripping, dadoing or grooving, rabbeting, routing, panel raising, shaping, sanding, etc

The Workace Radial Saw works from above. The motor is built in and directly connected. The saw and motor unit are mounted on a turn table 6 in. in diameter, which in turn is mounted on two heavy steel rods placed five inches apart to prevent any spring. Rods are mounted in a radial arm

The radial arm is mounted in the pedestal on a turn table 10 in. in diameter permitting the arm to be set in any position. The pedestal is also mounted on a turn table 10 in. in diameter. By means of these three turn tables the machine is readily placed in position for any kind of cutting. With an 8 in. blade it cuts $2\frac{1}{2}$ in. deep, a 9 in. blade cuts 3 in. The saw travels $19\frac{1}{2}$ in. in the arm and is adjustable vertically $5\frac{3}{4}$ in. The General Electric motor is of the ball bearing, universal type.

Cristite Alloys

CRISTITE, a special alloy of great hardness, has been successfully applied to certain aeronautic uses by the Commercial Alloy Corporation of San Francisco, Calif.

At the present time this metal has been used for surfacing airplane tail skids, and also for surfacing the valve stems of aircraft engine valves. In either case the Cristite metal provides an extremely hard wearing surface which imparts longer life to the parts thus surfaced. The Cristite is manufactured in convenient rods and is applied by welding. Tailskid shoes require a very thin coat of Cristite welded to the surface of the shoe to increase greatly the life of the shoe. Valve stems are ground down $\frac{3}{32}$ in. and a layer of Cristite is then welded on and the stem is re-machined to exact size. One advantage claimed for Cristite is that it may be applied easily, and is readily machined

Two special alloys are being manufactured in commercial quantities at the present time by the Commercial

Left—Valve stem machined for application of Cristite
Right—Standard cast steel tail skid shoe faced with Cristite.

Alloy Corporation, and are marketed under the name of Cristite Series 1, and Cristite Series 3. Cristite Series 1 shows a hardness on the Rockwell C scale of 61 to 67, while Cristite Series 3 shows a hardness of 49 to 55. Cristite Series 1 is the metal being used for aircraft application and various other commercial uses, the Series 3 being used for other purposes

SIDE SLIPS

By Robert R. Osborn

With new airplanes being produced in the great quantities that they now are we can see the industry soon confronted with a used airplane problem, and we suppose the used-airplane salesmen will soon develop the same old line—"Now here's just the ship you want. An old gent

owned it and only used it week-ends. Never flew faster than twenty miles an hour in his life. Hasn't gone over 5,000 miles and still on its first landing gear."

From our frequent experiences with the used car market, we have found that the 'old gent who never drove over twenty miles an hour' is as essential to the automobile industry as is our professional passenger, weighing thirty six pounds and with the perfectly streamlined head, who must be used by most of the airplane manufacturers in getting their flight test data.

. . .

"Transported in a Fokker tri-engined monoplane, the one millionth electrical refrigeration unit produced by Frigidaire Corporation, a General Motors subsidiary, has been taken to Atlantic City from Dayton, O. for display at the National Electric Light convention," news clipping called to our attention by H. P.

"The important case we called to see you about," we said, as we seated ourselves in the presence of the great Sherlock Holmes, "is an investigation into the mechanism of an electrical refrigeration unit, to see if it can be changed in any way to make it into an electric stove."

. . .

At least as far as aeronautics is concerned, it seems to be true that one cannot safely laugh at any new idea, however startling and revolutionary they may seem to be. Some time ago we were discussing in this space an engine advertised by a stock broker in New York as having a top speed of 80 m.p.h. and a landing speed of 35 m.p.h., and as we remember, our remarks were somewhat sarcastic in tone. Now according to the clipping, from a prominent aeronautical magazine, mailed in by H. K. McC. of Sugar Run, Pa., someone seems to be actually planning on using some of these engines and we may discover that the stock broker's advertisement wasn't as funny as we though. We quote from the clipping. "According to T——, these engines were purchased by an aircraft concern that is planning a non-stop flight around the world. The plan is for two twin-engined planes to make the flight, one descending for fuel at designated stations, the other engine remaining aloft for the entire flight."

. . .

We see that one manufacturer is advertising that his ship is designed to carry four people and a dog. This sort of thing is all right if it doesn't put some bad ideas into someone else's head. First thing we know, some

manufacturer of a cargo ship will be advertising that it can carry four grand pianos and an electric stove.

. . .

Mr. G. E. H., of Santa Barbara, Cal., mails in this query.

"I used to own a decrepit Jenny and I'm very anxious to get a new production plane. My wife is not nearly so keen about it, in fact, she hopes that I won't find the plane I want for the price I can raise. I notice in the "for sales" in AVIATION a HEALTH plane offered. Now it strikes me that this would be the proper plane to buy under the circumstances, and that Mrs. H should have no fear of going up even with me in such a plane. What do you think of it anyway? I am a very cautious man and don't want to make any mistakes. I want to be sure that this HEALTH machine is healthy for the pilot and passengers and not healthy for the undertaker."

We think the easiest way to sell this aviation idea to Mrs. H is to show her the "swell" flower vases, plush upholstery, cigarette lighters and window curtains now coming as standard equipment in some new airplanes.

The Intrepid Aviator read the above letter over our shoulder as we transcribed it, and suggested that we point out that the expression "decrepit Jenny" is redundant.

. . .

Mr. H. P., who is one of our most steadfast attention callers, calls our attention to a Glens Falls, N. Y., news item describing a local air meet, with the statement that among those present would be "A Waco J-5 sport plane, similar to the Spirit of St. Louis."

It must have been the similar shape of the radiators which fooled the reporter who wrote that article.

. . .

From J. E. M. of Chicago we have this communication.

"Here's a clipping from the esteemed Chicago *Tribune* about a 'Pilot Who Mounted 40,000 Ft. In His Mask.' What might the man have done if he only had an airplane too? Inasmuch as the F.A.I. has overlooked some of these record classifications can your department become a repository for them? For instance, there is the young man who flew over three thousand miles on six ham sandwiches and the numerous young ladies who have flown in the latest thing in flying clothes."

As J.E.M. suggests, some one should be taking care of these records, but we must decline the nomination. It's all we can do to keep track of the people who are flying electric stoves for the first time in history.

. . .

One of the directors of the British Air Ministry was quoted in the papers as being displeased with examination papers of officers seeking

promotion in the Royal Air Service. Among his other criticisms we find, "Several candidates found difficulty in expressing themselves and many unusual words were used."

As any one knows who has made a bad landing during his early flight training all American pilots may use many unusual words but none of them suffer from difficulty in expressing themselves.

ALEXANDER

.32 BULLET

Real speed and travel comfort for FOUR PEOPLE AND A DOG, with baggage for all, are attained in the new Alexander 32 Bullet. This economical cabin ship may be powered with either the Wright J6 165-hp or Kinner 100-hp motor. If you want a cabin ship, ask for details and place your order now.

EAGLEROCK BIPLANE

OX-5—90 H P

J S Gehan veteran pilot of Sioux Falls, S D flew home an OX-5 He sold it. Two weeks later he was in for another and ordered a third. He has tried all the OX-5 ships on the market and likes the Eaglerock best In visibility ruggedness, performance, ease of control and normal control in all positions it is close to perfection. It is the ideal ship for student training and for students after training It can be used in commercial work whereas most training ships are one purpose planes.

HISSO "A" 150 H P

The standard Hisso A Eaglerock with government overhauled motor ready to fly away for $4000 is by far the best seller we have Performance at top speed compares favorably with ships selling for twice as much It is one of the best balanced and most easily controlled Eaglerocks in the line. For advance training cross country work and general commercial flying it has no equal in low first cost and economical operation

CHALLENGER 170 H P.

In actual performance the 170-hp Challenger motored Eaglerock exceeded theoretical performance by a wide margin Top speed proved to be 130 miles per hour instead of 119 It is a wonderful ship for demonstrating sport flying and fast cross country work.

COMET 150 H P.

The Eaglerock with Comet 150-hp motor is very popular because of its performance, smoothness and small gas consumption of the motor Those who want flying ability and economy in the medium price class will appreciate the Comet motored Eaglerock

WHIRLWIND 225 H.P.

Powered with Wright J 5 225-hp motor the Eaglerock needs only to be flown to sell itself It is speedy has large carrying capacity and a comparatively slow landing speed In performance and economy it is unexcelled in its class.

A Ship for Every Purpose

For schools and operators in the formative stage we recommend the OX-5 for student training the Hisso A for advanced training and cross country work the Comet Challenger and Whirlwind for demonstrating sport and real fast cross country flying

Room 401, Alexander Industries
Colorado Springs, Colo.

Truly—PERFORMANCE WITH ECONOMY

TRUSCON
EFFICIENT HANGARS

Quickly Erected
Economically Priced
Fireproof Throughout

Types and sizes of Truscon Hangars and Steel Doors for every requirement.

These fireproof Truscon Hangars have unobstructed floor space and full opening doors to insure utmost ease in handling airplanes. They are designed to meet individual conditions with machine shop attached if desired. Truscon Hangars are fireproof throughout with Steel Windows, Steel Doors and insulated Steeldeck Roofs —all manufactured completely in the Truscon plant. Prompt delivery, quick erection and economical cost insure all-around satisfaction and greatest value.

Write for suggestions and quotations.

STEEL HANGAR DOORS

Truscon furnishes Steel Hangar Doors adapted to any type of construction or hangar design. They are sturdily built, of quality workmanship, operate easily and offer minimum interference to the movement of airplanes. Both Straight and Curved Track Types are available.

Write for full information and literature.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO
AERONAUTICAL DIVISION
Trussed Concrete Steel Co. of Canada, Ltd., Walkerville, Ont.
Offices in Principal Cities of United States and Canada

WRIGHT Writes To Us

Wright J-6 Whirlwind 9-Cylinder Engine

WRIGHT AERONAUTICAL CORPORATION
PATERSON N J
U S A

Vice-President

April 25, 1929.

U. S. Hammered Piston Ring Company,
Irvington, N. J.

SUBJECT: Piston Rings.

ATT: Mr. A.W. Wenzel.

Gentlemen:-

With full appreciation of the fact that your deliveries of U.S. Hammered Piston Rings are, on the whole, keeping step with our schedules, we believe it is time to draw your attention with some emphasis to the increasing demand for Wright engines of all models.

We have approximately 116,500 piston rings now on order with you, for use in our new "Whirlwind" Series and "Cyclone" engines. We shall be grateful if you will take steps to insure that deliveries of these rings are made as promptly as in the past.

The advance demand for new Wright "Gipsy" engines has proved to be very substantial, and we shall appreciate your making arrangements to meet our requirements for piston rings for this engine, as indicated in previous correspondence.

We feel confident that your fullest co-operation will be given in these matters, and wish to thank you for previous assistance in the rapid supply of piston rings in emergencies.

Yours very truly,

WRIGHT AERONAUTICAL CORPORATION

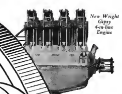
C. W. Vaughan
Vice President

GWV-3

USE THE AIR MAIL

AERONAUTICAL CHAMBER OF COMMERCE

—and We Reply



New Wright Gipsy 4-in-line Engine

U. S. HAMMERED PISTON RING CO
ST PETERSBURG FLA PATERSON N J

Oil Shall Not Pass

May 9, 1929

Wright Aeronautical Corporation,
Mr C.W.Vaughan, Vice President,
Paterson, N.J.

Gentlemen

Yours of the 25th awaits me, on my desk, upon my return from an out of town trip and is greatly appreciated. It is pleasant to know that our efforts to give you at all times not only quality in aviation piston rings but quality in service have met with such hearty approval.

It has been a matter of pride on our part that our rings have played so important a part in the upbuilding of Wright Aeronautical reputation and accomplishments.

But, if we have been of big service to you in the past, we write to point out to you that you will have every reason to expect even greater cooperation from us in the future. The demand for U.S.Hammered Aviation Piston Rings has mounted so steadily that we have been compelled again to increase our manufacturing facilities with the opening of a new factory having 30,000 additional square feet of floor space.

We will look forward to serving you with reference to your new "Gipsy" Engines, soon to go into production in a big way, and we prophecy for them the same remarkable success and popularity which your other famous engines have always known.

Very truly yours,

A.W.Wenzel, President.
U.S.HAMMERED PISTON RING CO.

AWW/ms

U.S. Side hammered rings hold compression under abnormal heat have no hammer marks or fractured metal and have a true circle flat surface and uniform wall thickness

USJ HAMMERED

U S AVIATION HAMMERED PISTON RINGS

U. S. Hammered Piston Ring Co., Paterson, N. J.

Proof—Conclusive Proof of Travel Air Owner Satisfaction Through Replies to Questionnaires

Travel Air has sold and delivered over 1000 biplanes and cabin monoplanes. Recently the owners of these planes were asked to answer a questionnaire telling frankly what they thought of their Travel Air and of Travel Air service. Here are two of the hundreds of replies already received. Read and be convinced. Other replies will be reproduced in this magazine next week.

QUESTIONNAIRE

1. When did you purchase your Travel Air plane?
   I purchased my Travel Air plane October 25, 1928
2. What is the Serial Number on your plane?
   It is 665
3. Have you always been satisfied with it?
   I have always liked my Travel Air Plane very much, and I have been well satisfied.
4. If so, will you please name the features that appeal to you most forcibly in this plane?
   The best feature is its easy handling in the air; second, it is the most stabile ship ever flown; very good ship for student instruction.
5. If not, what have been your difficulties?
   No difficulties whatsoever.
6. Have you any suggestions to offer?
   I have no suggestions to offer—I have been well satisfied.
7. Have you always received satisfactory service and shipment on parts?
   I have never ordered any parts as yet but I know that prompt service is always received.
8. In general how are you satisfied with Travel Air Products, and would you buy another Travel Air if we had a Model that would suit your requirements?
   I would buy another Travel Air Plane and I think the Curtiss Challenger that Mr Hansley has at Madison is certainly a wonderful ship.
9. May we quote you in our advertisement?
   I wish that you would quote me in your advertisement because I have been very well satisfied with my Travel Air Plane. I believe I am the youngest owner of a Travel Air. I am only seventeen years of age and I have had approximately eighty hours of flying my Travel Air. I am a Senior in high school and can only find time to fly on Saturdays and Sundays but I put in about four hours every week end.

Sincerely yours,

Gilbert Meyer

QUESTIONNAIRE

1. When did you purchase your Travel Air Plane?
   July 18, 1928
2. What is the Serial Number on your plane?
   No. 628
3. Have you always been satisfied with it?
   Yes
4. If so, will you please name the features that appeal to you most forcibly in this plane?
   Ease of control, stability, type of construction, general appearance and workmanship.
5. If not, what have been your difficulties?
6. Have you any suggestions to offer?
7. Have you always received satisfactory service and shipment on parts?
   Receive excellent service from Nicholas Beasely Airplane Co., Marshall, Mo.
8. In general how are you satisfied with Travel Air Products and would you buy another Travel Air if we had a model that would suit your requirements?
   Am thoroughly sold on Travel Air and intend to get a different model at a later date.
9. May we quote you in our advertisement?
   Yes, sir.

Yours truly,

James A. Emmerick,
Box 103, Nekoosa, Wis.

"The Standard of Aircraft Comparison"

TRAVEL AIR COMPANY

WICHITA, KANSAS

Send for the Story of Travel Air New Edition Free on request

KILL FIRE WHILE IT IS YOUNG

FIRE!

A disaster or an incident to your airport?

It can be whichever you choose! Disaster if the airport upon which money has been spent so hopefully becomes a dark, smouldering blot which flyers must pass by.

An *incident* if you are equipped with the proper fire extinguishing equipment—to kill fire at its most susceptible moment—its start!

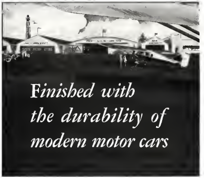
American-La France and Foamite Products include every recognized type of fire fighting equipment from one-quart extinguishers to the largest motor fire apparatus, used by 90% of America's cities. Whether you need "first aid" fire equipment, an automatic system or motor fire apparatus, which can quickly be rushed to any part of your airport, you will find an American-La France and Foamite product that exactly fits your needs—a product backed by over 84 years' experience in the one business of fighting fires! American-La France and Foamite recommends and installs this equipment; instructs your employees in its proper use, if desired, services equipment at regular intervals. Let one of our engineers talk over your airport protection problem with you. It obligates you in no way.

A booklet "Warning Beacons" describes airport hazards and the correct fire protection for these hazards. American-La France and Foamite Corporation, Engineers and Manufacturers, Dept. T50, Elmira, N. Y.

American-La France and Foamite Corporation, Dept. T50 Elmira N. Y.
☐ Please send me your booklet "Warning Beacons"
☐ Have a Fire Protection Engineer call
Name ______
Company or City Dept. ______
Town or City ______
State ______

AMERICAN-LAFRANCE AND FOAMITE PROTECTION

A Complete Engineering Service
For Extinguishing Fires



Keen competition in the air today makes new demands for beauty, style and utmost serviceability

IT was du Pont who developed the modern durable finish for the automotive industry. Equally alert to the special needs of aviation, du Pont now offers aircraft finishes as modern as today's most advanced airplane design.

Clear wing dope, pigmented dope, standard Army and Navy finishing material, dopeproof paint—in fact, every finish needed in airplane construction—supplied by du Pont.

And every du Pont aircraft finish is a product of extensive research in the most modern laboratories—a result of many years experience in the aircraft field—and a product rigidly tested in the most gruelling flying service.

The du Pont line is so complete, so scientifically perfected, that you can safely base your whole finishing schedule on du Pont finishing systems.

Color Experts at Your Service

With the introduction of Duco for use in homes, on automobiles and other manufactured products, du Pont established a special department for the study of color trends and color fashions. The du Pont Color Advisory Service is in constant touch with aircraft styling in both America and Europe. It will gladly cooperate with you in planning up-to-the-minute harmonies for your ships.

Complete information on any du Pont product for airplane use will be furnished either by mail or by a qualified representative.

AIR-TESTED FINISHES

Du Pont Dopes—The du Pont line of aircraft finishing materials includes clear, semi-pigmented and pigmented dopes. They are all tested formulas of remarkable durability—proven in service as well as in the laboratory. Flexible and highly blush-resistant, the Army and the Navy have approved these products for their requirements. Available in a wide variety of highly visible colors.

Du Pont Paints and Varnishes—Du Pont chemists have developed a complete line of paints and varnishes including Dopeproof Paint, Spar Varnishes, Fuselage Varnish and Aircraft Enamels.

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., Inc.

Industrial Finishes Division, Parlin, N. J.

2100 Elston Ave., Chicago, Ill. — 351 California St., San Francisco, Cal.

Flint Paint and Varnish Limited, Toronto, Ontario, Canada

PYRALIN and FABRIKOID bring valuable refinements in passenger planes

MORE planes for commercial passenger lines—more ships for private owners! Luxury gains new importance in competitive selling of aircraft.

It would be difficult to find two materials so preeminently suited to this need of modern aviation as du Pont Pyralin and Fabrikoid. Extremely light and highly durable, they meet the practical requirements of materials employed in air service. And their beauty adds the smart refinements that mean both luxury and comfort in the cabin and cockpit.

Cabin windows, instrument boards and wing lights of 100% transparent Pyralin combine beauty and the necessary strength and lightness for air service. Made in various colors and effects, Pyralin will richly supplement any color scheme. Complete information on Pyralin for these and other uses will be furnished on request.

In the cockpit and the cabin, du Pont Fabrikoid provides upholstery that is handsome, modern, practical. Light in weight, tough, waterproof and strikingly attractive, the new Nemoursa Aeroplane Fabrics give your ships the luxurious comfort of the finest yachts and motor cars.

Let our technical men cooperate with you in applying Pyralin and Fabrikoid with maximum effectiveness. Please address the division concerned.

AIR-TESTED MATERIALS

Du Pont Fabrikoid—Sturdy Fabrikoid is an ideal material for open cockpit upholstery. Will withstand varying weather conditions. "Nemoursa Aeroplane Fabrics" are new type, light weight materials developed for interior trims of cabin ships. Made on a high-grade woven cotton base and treated with appropriate pyroxylin colors. Embossed in distinctive patterns.

Du Pont Pyralin—A strong, durable, light, unbreakable, transparent material furnished in any gauge from 5/1000 upward in sheets approximately 20 in. x 50 in. Ideal for windshields, cabin windows, running lights and other uses.

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., Inc.

DU PONT VISCOLOID CO., Inc.

330 Fifth Avenue, New York City

FABRIKOID DIVISION — Newburgh, New York

M E M B E R O F A E R O N A U T I C A L C H A M B E R O F C O M M E R C E

THANK YOU *for mentioning* AVIATION

Testing for toughness at the Impact machine

Testing for hardness on the Brinell machine.

Ruggedness and reliability in an aircraft engine begin with the choosing and testing of materials to be used. In the American Cirrus Engine highly stressed parts such as crankshafts, camshafts, gears, studs, bolts, rocker arms, etc. are made of the finest nickel and nickel-chromium steels. These steels are heat treated to give the desired physical properties and are then passed through a complete chemical and metallurgical test in our laboratory, which is equipped with the best and most modern machines for this purpose. Our test specifications are extremely high and the materials that meet these qualifications assure the engine extreme reliability and long wearing qualities in performance. These are not matters of luck but are caused by the proper choosing and testing of material

AMERICAN CIRRUS MARK III

AMERICAN CIRRUS ENGINES, INC.

WASHINGTON AVENUE, BELLEVILLE, N. J.

SUPER QUALITY GASOLINE HOSE

This undoubtedly is the finest quality gasoline hose available on the market. Far better in principle and vulcanized ply construction. Fully guaranteed to meet the most exacting air service specifications and commercial requirements. Fabric lined, alternately ply and rubber construction. Exceptionally strong and durable.

PRICES

⅜ inch diameter per foot	$0.50
½ inch diameter per foot	.60

RAJAH SPARK PLUG TERMINALS

This is the popular lip lock type that make a firm firmly conductive contact. Made of a special alloy that will retain it spring strength and yet offer no resistance to current. Securely locks on spark plug, always remains tight. Easily attached. Bushing end [illegible] insulator [illegible]
Price each $0.[illegible]

ZENITH ALTIMETER

The Zenith Altimeter is an [illegible] instrument that [illegible] an accurate reading at all times. It is very popular and [illegible] all the refinement and accuracy of instruments found in the most expensive types. Accurately calibrated and adjusted, each instrument comes to you in perfect condition after field testing.

Commercial flyers use this instrument in preference to all others and it is undoubtedly a rare bargain at the special price
Only $15.00

Robertson Prices *are generally* Lower—

Robertson purchases are made in quantities that command lowest prices obtainable. For, behind the Robertson organization are the entire financial resources of the Universal Aviation Corporation, furnishing a purchasing power unequalled in the industry. In some cases, the manufacturer's entire output is contracted for. Thus Robertson, in practically every case, undersells all other sources of supply.

Robertson dependability is recognized by all. Only A-N and popularly accepted commercially standardized materials are stocked. Stocks on all parts and supplies are complete. Service is prompt. For every aeronautical need, call on Robertson.

Our new supply catalogue will be mailed you on request. Write for your copy today.

Dept. W-6

Robertson Aircraft Corporation

ALL AERONAUTICAL SUPPLIES

Lambert-St. Louis Airport, Anglum, St. Louis County, Mo.

Official Wright Whirlwind Parts Dealers and Maintenance and Supply Depot. All Whirlwind parts ready for immediate shipment at standard factory prices

Division Universal Aviation Corporation

PYRALIN SHEETING
Absolutely Colorless

From our stock you will receive only absolutely clear first-grade pyralin—not the dark colored pieces of an inferior quality. And our careful handling and shipping insure you against scratchy blurred sheets.

Old Pyralin windshields of an inferior grade that have turned yellow with age and obstruct vision should be replaced with this fine quality material.

Genuine Pyralin will withstand extreme exposure and will remain clear. It is easily cut and fitted. Guaranteed A N Specification.

Sold in the standard size sheet only—20x50 inches. One sheet usually required for making both front and rear windshields in the popular type open cockpit biplanes.

All gauges. Reasonably priced

N528

Famous for performance

Built for SAFETY!

You don't have to be a Lindbergh to judge the exceptional air-worthiness of the Ryan. One inspection tells you that here is no fair weather ship, but a craft engineered to withstand the unexpected stress and strain of dirty weather.

You see it in the Ryan's externally-braced wing construction—the strongest known. Its superiority to other types is readily apparent when you consider the heavier pay loads ships must carry today. Furthermore, it permits adjustments to compensate warping, which are impossible in the cantilever type wing.

You see it in the exclusive Ryan designed chassis with axle of Chrome Molybdenum steel tubing—the landing gear that stood up under the terrific shock of two and one-half tons weight on the take-off of the historic Paris flight. A landing carriage that will stand the gaff when you hit the dirt of the roughest fields.

You will see it, too, in the braces through the center of the Ryan's cabin. No other ship offers this safeguard to passengers and plane against the racking strain of rough landings. It adds materially to the life of the ship. And if the fabric were removed, you could see it again in the steel-tubing fuselage, master-welded at the joints and braced against torque and strain by diagonal steel members. Such *plus* construction characterizes the Ryan from spinner cap to rudder. It makes the world's most famous ship the safest, too.

As to performance, the whole world knows what the Ryan can do. Here (at left) are a few details which "Red" Harrigan, at the factory, or any Ryan distributor, will gladly demonstrate.

Send for new, illustrated catalog of the new Ryan Brougham for six, powered by the Wright Whirlwind J-6 engine. Mahoney Ryan Aircraft Corporation, Lambert-St. Louis Airport, Anglum, St. Louis County, Missouri.

Take-off with load
8 seconds. 275 ft.
Climb, 1200 ft. per min.
Top Speed, 140 m. p. h.
Cruising Speed
120 m. p. h.
Service Ceiling
18,000 ft.
Absolute Ceiling (light)
25,000 ft.
Landing Speed
50 m. p. h.
(Lands within a 200 ft circle)
Department of Commerce Approved Type Certificate No. 142

The New Model RYAN Brougham For Six

SISTER SHIP OF THE "SPIRIT OF ST. LOUIS"

What's all the mystery about Airport Lighting?

By E. J. DAILEY
Lighting Sales Manager
Graybar Electric Company

This is Number 3 of a series of advertisements whose purpose it is to reduce the information on airport lighting to its simplest terms.

1. What are the three simple "fundamentals" of good airport lighting?

First, the ideally lighted field is easily found at any time of night. *Second*, it is easily identified. And *third*, it is as easy and safe to land upon by night as by day.

2. What lighting provisions are required for an "A" rating?

An "A" rated field is essentially a well lighted field. For an "A" rating, the Department of Commerce lists seven requirements: An airport beacon. Boundary lights. Obstruction lights. Hangar floodlighting. Field floodlighting. An illuminated wind direction indicator. A ceiling finder.

3. In what ways must equipment aid the pilot?

After it has helped to locate and identify the field, lighting should give the flyer a "picture" of the whole landing area — as it would appear in the daytime.

He must know the direction of the wind. Obstructions must be clearly marked by red lights, the best approaches by green lights. Hangars and other buildings should be floodlighted to aid the pilot in judging height and distance . . . Finally the field itself should be floodlighted, but without objectionable glare.

4. In general, what should good airport lighting accomplish?

Equipment alone does not make good airport lighting. Nor is there a "system" which will meet the requirements of *all* airports.

Good airport lighting, boiled down to its final meaning, is the *reduction of all landing hazards to the absolute minimum.*

5. How should lighting be installed?

The individual requirements of the particular field should largely determine the location and type of equipment. Good lighting is a matter of *correct* application.

6. Does it pay?

Beyond question of safety, there need be no doubt as to the *commercial* value of an investment in airport lighting. Competition among airports—the development of night flying—the growth of public interest—these have all progressed to such a point that airport lighting has become of immediate importance.

* * *

At this point, let us suggest that Graybar's Airport Lighting Department is at all times ready to offer its cooperation and experience in solving the individual problems that present themselves on any given field . . . See coupon

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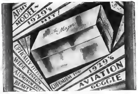

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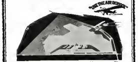

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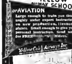

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NEW Paragon and Star props for OX-5, $20 and $30. 1Y pigs $8. 1 water pump $8. 1 zenith carb. $20. 1 center section uncovered with fittings, $10. 2 uncovered ailerons $10 each. Clipped wing ailerons covered $7.50 pair. 1 fin covered $2. Above for standard. OX-5 Prop hub complete less bolts, $5. Croft Machine Shop Moberly Mo.

ONE Stearman Biplane J-5 for sale 160 hours. Ship and motor perfect condition. Make offer. FS-96 Aviation Tenth Ave. at 36th St., New York.

ONE Stinson Jr., Warner Motor for sale 60 hours kept in hangar priced at a real bargain. One new OX-5 Eaglerock, one Hisso Eaglerock. Write or wire Wichita Falls Air Transport Co., 1200 Staley Building Wichita Falls Texas.

OXX 6 Jenny for sale. Identified cover and dope one year old motor has 15 hours since overhaul stored in hangar over winter ship now flying $800. Sunbury Airport Sunbury Pa.

OX-5 JN4D Curtiss. Just the ship for the ambitious student to get a lot of time in at a low cost. Bring your car. I will sell for cash or trade. R. F. Bonnell Camanche Iowa. Price $650.

PROPELLERS OX-5 toothpick, $30. Clark $20 used $18. Lawrence $25. Mercedes $30. Hispano $40. Le Rhone $25. Gnome $30. Zenith Altimeters used $8.50 new $15. Air Speed Indicators new $15. Banking Indicators, new $5. 26 x 5 wheels tires and tubes $40 your wheels taken in trade. Lawrence engines new $125. Gnome 50 H.P. sport plane engine new, $125. Glider kits parts $3 with complete working plans. DH wheels $9 each. Curtiss wings $50. Standard wings $75. Thomas Morse Tail units $15. Midway Aero Company P. O. Box 284 St Paul, Minn.

SALE Velie Monocoupe motor and plane in excellent condition. Always kept in hangar. Priced reasonable for immediate sale. Buying larger plane. Francis Gladen Deerfield Illinois.

SPARTAN Biplane—Department of Commerce approved type 9 cylinder Siemens-Halske motor. Total time one hundred seventy hours. Twenty hours since general overhaul. Less than year old. Never in a crack-up and perfect throughout. Cost $6,000. Priced at $3,800 for quick sale. Geo. Searle, 406 Dearborn Building Dearborn Michigan.

STINSON Detroiter Monoplane. Six place, never cracked. 80 hours since factory motor overhaul three hours since complete ship overhaul Stinson factory which included recovering wings, fuselage tail surfaces, painting blue and gold upholstering cabin new control cables and pulleys throughout, new motor cowling. Spare standard steel propeller. Priced for quick sale at $7,500. Pal-Waukee Airport Inc. Mt. Prospect Illinois.

TWO OX-5 motors rebuilt like brand new. High compression pistons. Miller overhead turns 1,600 on test stand guaranteed. $580.00 each. Act quick. Tri-City Air Services Inc. 100 Prairie St., St. Charles Ill.

TWO OX-5 Travel Air biplanes best of condition dual controls, compass night lights, center section gas tank, etc. with D. H. wheels, neither can be told from new. Both have had excellent care and are licensed. Owner going abroad must sell. See them Stewart Aircraft Company Hangar Cleveland Municipal Airport Cleveland, Ohio.

VELIE M-5 motor 25 hours rebuilt monocoupe wing uncovered also wheels and tail surfaces. James E. Dodge Rochester Minn.

WACO 10 FOR SALE. Like new, extras equipment high compression pistons motor turns 1625 sacrifice $1,750.00 getting larger ship. M. Kubirt Nash Bake St. Charles, Ill.

WACO TEN approximately 75 hours. This motor brand new when originally purchased and turned 1400 on ground. Dual controls compass Hartzell prop., etc. and looks like new. Completely licensed. Privately used and always under cover. Price $1,400. For information phone or write E. Roth Syracuse Airport, Syracuse N. Y. Phone Prospect 407.

EQUIPMENT WANTED

CASH for best offer of licensed used new production plane. Waco or Travel Air preferred. Dual control. Write full particulars to C. O. Mohr 3823 Beard Ave., So. Minneapolis Minn.

J-5 MOTOR wanted complete with propeller—must be guaranteed. Send by air mail detail information with best cash price. Also want head for Pioneer speed indicator and bank and turn instruments. R. T. Barber Geneva Kansas.

WANTED Serviceable air-cooled motor 40 to 65 hp. No rotaries. Give description fully. Can use accessories. M. Brewold, McCloud California.

POSITIONS VACANT

AIRCRAFT inspectors men experienced on hull and cowling also doping and finishing. Army and Navy Standards. Answer in writing giving complete qualifications. P-81 Aviation Tenth Ave. at 36th Street New York.

DRAFTSMAN wanted. Aeronautical mechanical or structural with experience in layout and detail work. Kreider-Reisner Aircraft Co. Inc. Hagerstown Md.

ESTABLISHED Eastern company wants layout draftsman project engineers stress analysis men and men familiar with weight control. Only men with airplane experience need apply. Give full particulars as to experience and salary. P-97 Aviation Tenth Ave. at 36th St. New York.

EXPERIENCED engineers and draftsmen in aeronautical or mechanical engineering wanted. Opportunity for capable men to enter manufacturing company with excellent future and enjoy expansion. Write detailed experience and salary first letter. P-82 Aviation 820 No. Michigan Ave. Chicago Ill.

EXPERIENCED aeronautical engineer wanted. Must be capable of taking full charge. Must know general design and layout. Excellent opportunity. P-75 Aviation Tenth Ave. at 36th Street New York.

EXPERIENCED airplane and mechanical draftsmen wanted layout men and experienced detailers. State salary and past experience. Command Aire Inc., Little Rock Ark.

THREE licensed pilots wanted desiring instruction on Ford Tri-Motor. Must be well educated will dressed able to pay own expenses willing to work long hours. To three such men we will give tri-motor time at $5.00 per flying hour. Straight instruction with no work $150.00 per hour. Answer immediately. Capt. O. M. Goodell Ameriman Bank, Fort Clinton Ohio.

(Continued on the following page)

WANTED
Used Aircraft and Motors
all types give full particulars and lowest price
NORTHERN AERO CORP
4 Hanover Square, New York City
Phone Bowling Green 6625

ALPHABETICAL INDEX TO ADVERTISERS

SEARCHLIGHT

AIRCRAFT SERVICE DIRECTORY

MANUFACTURERS' SPECIFICATIONS ON AMERICAN COMMER

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT AVIATI

This table will appear monthl

MANUFACTURER	Designation	Price of Plane at Factory	Type	No. of Seats	Make of Engine	Total Rated HP	Make of Propeller	Span	Wing Area (Sq. Ft.)	Length Overall	Height Overall	Weight Empty (Lb.) with Water if Water Cooled Engine is Used	Pay Load (Lb.)	Disposable Load (Lb.)	Normal Gross Weight Loaded (Lb.)	Wing Loading (Lb. per Sq. Ft.)	Power Loading (Lb. per H.P.)
Advance Aircraft Co.	Waco 10	$2,035*	OBL	3	OX 5	90	Hs	30' 7"	288	23' 6"	9'	1,225	300	800	2,025	5 08	22 5
Advance Aircraft Co.	Waco 220	7,341	OBL	3	J 5	200	H Hs, SS	30' 7"	280	22' 6"	9' 3"	1,550	800	[illegible]	2,500	9 04	15 0
Aero Craft Mfg. Co.	Aero-Coupe	5,300	SBL	3	W	110	F	32'	250	24'	8' 6"	1,100	550	1,000	2,100	8 40	17 3
Alexander Aircraft Corp.	Eaglerock A-1		OBL	3	J 5	200		36' 8"	330	24' 11"	9' 11"				2,491	5 54	15 6
Alexander Aircraft Corp.	Eaglerock A-2	2,250*	OBL	3	OX 5	90		36' 8"	330	24' 11"	9' 11"				2,442	5 40	27 1
Alexander Aircraft Corp.	Eaglerock A-4		OBL	3	E	180		36' 8"	330	24' 11"	9' 11"				2,619	5 95	14 5
Alliance Aircraft Corp.	Argo	4,300	OBL	2	Wr	155	SS	28' 8"	205	19' 6"	9'	1,000	265	650	1,650	8 15	15 5
American Eagle Aircraft Co.		2,885	OBL	3	OX 5	90	H Hs	30'	300	24' 6"	8' 4"	1,372	840	850	2,055	6 85	22 2
Arrow Aircraft Corp.	Arrow-Sport	2,945	OBL	2	LB	60		25' 6"	178	19' 5"	6' 11"	554		450	994	5 55	16 2
Bach Aircraft Co.	Air Yacht	51,800	CSHL	10-15	3 Sh 15 pass	650	Sty SS	52'	412	36' 1"	9' 6"	3,500		5,300	6,300	15 27	[illegible]
Bellanca Aircraft Corp.	CH	14,500	CML	6	J 5	200	Hs	46' 4"	273	24' 9"	8' 6"	1,850	2,229	5,284	5,134	18 87	25 6
Berliner Aircraft Co.	CM 4	3,290	OML	3	OX 5	90	H Hr	36'	219	25' 10"	8'	1,400		900	2,300	10 50	25 5
Berliner Aircraft Co.	CM 5	8,750	OML	3	J 5	200	SS	36'	219	25' 10"	8'	1,653		1,025	2,700	12 55	13 5
Bird Wing Commercial Airplane Co.	No. 6	2,565	OBL	3	OX 5	90	Hr	31' 4"	303	25' 6"	8' 5"	1,236	550	1,019	2,255	7 44	25 0
Boeing Airplane Co.	40-B	24,500	SBL	3	P Wh	400	H M	44' 5"	545	33' 4"	11' 8"	3,585	1,428	2,536	6,121	11 15	15 1
Boeing Airplane Co.	40-C	22,500	SBL	3	P Ww	400	H M	44' 2"	545	33' 4"	11' 8"	3,522	1,445	2,533	6,055	11 14	12 1
Boeing Airplane Co.	B-1E	18,900	CBF	6	P Ww	400	HW	39' 8"	545	33' 4"	15'	3,390	750	1,460	4,550	8 36	11 3
Boeing Airplane Co.	B-1D	15,900	CBF	4	J 5	200		39' 8"	460	30' 9"	15'	2,445	720	1,000	3,442	7 56	17 2
Bourdon Aircraft Corp.	Kitty Hawk	5,200	OBL	3	Sh 14	105	W	28'	233	22' 6"	8' 6½"	1,142	380	308	1,950	8 36	18 5
Breese Aircraft Co.			CML	6	J 5	300	SS	41'	280	27'	10' 6"	[illegible]		1,160	3,550	9 80	15 7
Buhl Aircraft Co.	Airsedan CSA	13,500	CSL	3	J 5	300	SS	45'	354	28'	10'	2,272	1,300	1,428	3,700	11 07	18 5
Buhl Aircraft Co.	Airsedan CA 5C	12,500	CSL	3-4	J 5	300	M	36'	240	28'	8' 6"	1,800	655	1,400	3,200	13 35	16 0
Buhl Aircraft Co.	Junior Airsedan	8,500	CSL	3	W	110	M	36'	240	23'	8' 6"	1,300	520	1,000	2,338	10 42	22 7
Cessna Aircraft Co.	3-120	3,750	CML	3	A	120	H Hr	40' 6"	224	25' 8"	7' 4"	1,550	800	750	2,300	8 92	16 6
Cessna Aircraft Co.	4-155	4,975*	CML	4	Sh 12	125	H Hr	40' 6"	224	25' 8"	7' 4"	1,200	700	1,050	2,250	10 17	18 5
Cessna Aircraft Co.	4-200	9,500	CML	4	J 5	200	H Hr	40' 6"	224	25' 8"	7' 4"	1,550	800	1,070	2,620	10 80	12 1
Command-Aire Inc.	Command-Aire	2,450*	OBL	3	OX 5	90	H	31' 6"	300	24' 6"	8'	1,555	555	800	2,025	6 91	25 0
Curtiss Robertson Airplane Mfg. Co.	Robin	4,000	CML	3	OX 5	90	Hs	41'	245	25' 9"	7' 10"	1,489	529	728	2,215	9 04	24 6
Davis Aircraft Corp.	V-3	2,565	OML	2	LB	60	Hs	30' 6"	145	19' 6"	7'	773	350	380	1,300	8 96	28 4
Driggs Aircraft Corp.	Dart II	1,300	OBL	2	A 3	33	Hs	28'	140	19' 6"	6'	450		370	820	3 85	23 4
G. Elias & Bro. Inc.	Aircoupe	3,350	CBL	2	A	60	Elias	28' 1½"	195	21'	7' 2"	870	318	564	1,394	6 96	14 6
Fairchild Airplane Mfg. Corp.	Fairchild 21	4,250	OBL	2	G	80	HW	28'	139	22'	7' 10½"	733		495	1,250	8 99	13 1
Fairchild Airplane Mfg. Corp.	Fairchild 41	9,950	CML	4	J 5	300	Hw	39'	234	24' 5"	8'	2,300		1,600	3,000	15 38	18 0
Fairchild Airplane Mfg. Corp.	Fairchild 51	18,000	CML	7	P Ww	400	SS	50'	332	32' 10½"	9' 4"	3,000		2,900	5,500	16 56	15
Federal Aircraft Corp.	CM-1	12,500	CML	3	J 4 B	200	Ws	37' 6"	282	29' 3"	9'	2,000	630	1,395	3,425	13 21	17
Fleet Aircraft Inc.	Fleet Model 1		OBL	2	W	110		28'	195	20' 9"	8' 9"	976		554	1,350	7 84	13 1
Fokker Aircraft Corp.	Universal	15,300	CML	5-7	J 5	200	H Hs	45' 9"	300	33'	7' 10"	2,300	1,050	1,300	4,000	11 73	15
Fokker Aircraft Corp.	Super-Universal	21,300	CML	6-8	P Ww	400	SS	50' 7"	550	36' 7"	8' 11"	3,000	1,134	2,150	5,150	15 98	12 8
Fokker Aircraft Corp.	Fokker F 10	67,300	CML	14	3 P Ww	1,200	SS	79' 3"	850	50'	12' 8"	7,930	2,492	3,520	13,100	15 41	10 9
New Standard Aircraft Corp.	D-24	6,000	OBL	5	E	180	H	43'	350	28' 6"	10' 2"	2,300	770	1,534	3,400	9 71	18 9
General Airplane Corp.	Aristocrat	5,300	CML	3	W	110	SS	36' 4"	194.5	25' 2"	7' 7"	1,248	365	862	2,100	10 84	19
Hamilton Metalplane Co.	H-45		CML	8	P Ww	420	H	54' 5"	387	34' 8"	9' 4"	3,300	1,153	2,400	5,750	14 55	14
Hamilton Metalplane Co.	H-47		CML	8	P Wh	500	H	54' 5"	387	34' 6"	9' 4"	3,450	1,043	2,300	5,750	14 85	11
Heath Airplane Co.	Parasol	695	OML		H	23	own	23'	94	16' 9"	5' 11"	300		225	515	5 45	22
International Aircraft Corp.	F-17	2,950	OBL	3	OX 5	90	H	35'	325	25'	9' 6"	1,300	320	620	2,100	6 47	23
International Aircraft Corp.	F-18	12,550	CBL	6	J 5	300	SS	55'	380	27' 6"	10' 6"	2,300	950	1,550	3,750	10 41	18
Ireland Aircraft Inc.	Neptune	14,000	CMA	5	J 5	300	CR	48'	338	31' 6"	11' 6"	2,250	750	1,350	3,500	10 50	16
Irwin Aircraft Co.	M T-3	1,165	OBL	1	179	25	own	20'	105	13' 6"	5' 9"	273	100	300	373	3 47	25
Keystone Aircraft Corp.	Patrician	90,500	CML	20	3 Cy	1,555	SS	90'	1,300	63'	13'	8,505	3,380	2,615	15,000	13 00	9
Keystone Aircraft Corp.	Pathfinder		CBL	12	3 J 5	900		66' 6"	1,150	48'		6,536	1,800	4,481	10,841	9 42	16
Kreider-Reisner Aircraft, Inc.	Challenger C-2	2,243*	OBL	3	OX 5	90	Hs, H	30' 1"	266	23' 9"	9' 4"	1,300	415	811	2,011	7 56	22
E. M. Laird Airplane Co.	Commercial		OBL	3	J 5	200	SS	34'	300	23' 6"	9' 3"	1,550	300				
Lincoln Aircraft Co.	Lincoln-Page		OBL	3	OX 5	90		32'	300			1,200	450	1,000	2,200	7 35	24
Lockheed Aircraft Co.	Vega		CML	5-7	J 5	200	SS Ws	41'	275	27' 5"	8' 6"	1,650	1,000	1,550	3,200	11 64	16
Lockheed Aircraft Co.	Air Exp.		CML	5-7	P Ww	400	SS	41'	275	27' 5"	8' 6"	1,850	1,000	1,845	3,845	13 25	9
Loening Aeronautical Engr. Corp.	Cabin Amphibian	27,000	CBA	8	Cy	525	SS	46' 8"	517	34' 8½"	13' 3"	3,950	1,100	1,950	5,900	11 41	11
Mahoney-Ryan Aircraft Corp.	Ryan B-4	17,200	CML	5	J 5	300	H W	42'	280	27' 9"	9' 10"	1,870	300	1,450	3,300	11 57	16
Metal Aircraft Co.	G 2-W	31,000	CML	8	P Ww	410	SS	50'	365	32' 6"	9' 6"	2,300	1,455	[illegible]	5,300	15 34	15
Mono Aircraft Inc.	Monocoupe	2,675	CML	2	V	55	Hr	30'	150	19' 6"	6' 3"	700		455	1,155	5 45	21
Mohawk Aircraft Corp.	Pinto	2,775	OML	2	V	55		30' 6"	124	22'	6' 3"	850	200	500	1,350	10 88	24
Paramount Aircraft Corp.	Cabinaire	7,200	CBL	4	W	110	SS	34' 8"	322	23' 9"	9'	1,300	620	300	2,300	6 83	20
Pheasant Aircraft Co., Inc.	H-10	2,575	OBL	3	OX 5	90	Hs	32' 6"	285	23' 4"	9'	1,297	500	785	2,082	7 35	23
Pitcairn Aviation Inc.	Mailwing	10,500	OBL	1-5	J 5	200	SS	33'	257	22' 10"	8' 10"	1,612	500	770	2,345	9 96	12
Pitcairn Aviation Inc.	Super Mailwing		OBL	1-2	J 5	300		33'	285	22' 10½"	9' 3"	1,840		1,190	3,000	11 19	15
Pitcairn Aviation Inc.	PA-4		OBL	3	OX 5	90	Hr	30'	226	21' 10"	8' 7"	1,165		785	1,950	8 62	21
Prudden Aircraft Corp.	S-E-1	22,500	CML	8	P Ww	400	SS	55'	427	38'	9' 5"	3,300	1,200	2,085	5,085	11 86	12
Richmond Airways Inc.	Sea Hawk		OSHF	5	C 6	160		[illegible]	517	38'		1,300		1,300	2,300	8 31	16
Sikorsky Mfg. Co.	S-37		CBL	18	2 P Wh	1,000		100'	1,049	63' 6"	16' 3"	8,300	4,000	7,200	13,000	14 29	15
Sikorsky Mfg. Co.	S-38 Amphibian		CQA	10	2 P Ww	900	SS, B	71' 8"	720	40' 3"	13' 10"	6,500	2,510	4,300	10,560	15 08	15
Simplex Aircraft Corp.	Red Arrow	5,550	CML	2	K 5	100	Sty	35' 4"	148	20' 3"	6' 10"	1,300		300	1,600	10 41	16
Starling Aircraft Co.			OBL	3	OX 5	90		32'		23' 4"	9'	1,257		300	1,855		20
Stearman Aircraft Co.	C-2-K	6,540	OBL	3	Sh 15	125	H Hs	[illegible]	296	24'	9'	1,285	350	865	2,150	7 26	17
Stearman Aircraft Co.	C-2-B	8,530	OBL	3	J 5	200	H CR	[illegible]	296	23'	9'	1,458	400	965	2,900	8 10	15
Stinson Aircraft Corp.	SM-1D	15,500	CML	6	J 5	300	H	45' 10"	292	32'	8' 6"	2,300	1,340	5,100	4,500	15 41	55
Stinson Aircraft Corp.	Junior SM-2	6,930	CML	4	W	110	Wd	41' 6"	234	28' 3"	7' 9"	1,510	595	990	2,300	10 53	55
Spartan Aircraft Co.	C-3	5,250	OBL	3	Wal	135		32'	293	22' 11"	8' 9"	1,300	448	850	2,150	5 35	15
Stout Metal Airplane Co.	4 AT		CML	12	3 J 5	600	SS	74'	785	49' 10"	12' 6"	6,200	2,300	3,600	10,000	15 75	16
Swallow Airplane Mfg. Co.	Commercial		OBL	3	OX 5	90		32'	300	24'	8' 6"	1,470	380	550	2,200	5 53	24
Stockly Aircraft & Engine Co.	Flying Dutchman	5,000	OML	1	Sx	40	F	[illegible]	108	18'	6' 6"	551.5	231.5		800	7 20	20
Taylor Bros. Aircraft Co.	Chummy	3,600	SML	2	K 5	100		[illegible]	175	22'	7' 6"	950	100	380	1,500	8 55	15
Texas Aero Corp.	Temple		OML		J 5	200		39' 4"	225	25' 10"	8' 3"		586		2,552	13 00	11
Thaden Metal Aircraft Co.	T-1		CML	7	P Ww	400		55'		35'	11'	5,000		5,200	3,100		12
Travel Air Mfg. Co.	2000	2,950	OBL	3	OX 5	90	H Hr	34' 8"	296	24' 2"	8' 9"	1,550	550	550	2,100	5 09	23
Travel Air Mfg. Co.	4000	9,100	OBL	3	J 5	200	H	34' 8"	296	23' 6"	8' 9"	1,600	[illegible]	1,000	2,500	8 28	15
Travel Air Mfg. Co.	6000	13,000	CML	3	J 5	200	SS H	46' 7"	285	30' 11½"	10' 8½"	5,455	744	1,525	4,100	14 55	20
Wallace Aircraft Co.	Touroplane "B"	4,885	CML	3	K	100	Hs	37'	212	25' 10"	8'	1,520	385	780	2,100	7 00	21
Whites Aircraft	Hum Bird	2,150	OBL	3	OX 5	90	Hr	33' 1"	318	23' 4"	8' 3"	1,050	450	850	1,900	5 94	21
Western Airplane Corp.	King Bird	2,500	OBL	3	OX 5	90	Hs	35'	330	23' 4"	9'	1,200	600	800	2,000	6 25	22

TYPE
A — Amphibian
B — Biplane
C — Closed
F — Flying boat
L — Landplane
M — Monoplane
O — Open
Q — Sesquiplane
S — Semi-closed
W — Seaplane

ENGINE One engine unless stated in italics.
A — Ansani
C 6 — Curtiss
Co — Comet
Cy — Wright Cyclone
E — Wright Hispano-E
G — Genet
H — Henderson
179 — Irwin
J 5 — Wright Whirlwind
K — Kinner
L — Liberty
LB — Le Blond
LR — LeRhone
OX 5 — Curtiss
P Wh — Pratt & Whitney Hornet
P Ww — Pratt & Whitney Wasp
SR — Super Rhone
SH — Siemens Halske
Sx — Szekely
V — Velie
Wal — Walter
W — Warner
Wr — Hess Warrior
* — Price without engine

PROPELLER
CR — Curtiss Reed
F — Flottorp
H — Hamilton
Hs — Hartzell
M — Metal
Sty — Story
SS — Standard Steel
W — Wood
Ws — Westinghouse

FUSELAGE
B — Bolted
Cor — Corrugat
D — Duralun
F — Fabric re
Mon — Monocoq
O — Open sec
BRAKES
B — Bendix
Ex — Extra
H — Hydraul

CIAL AIRPLANES AND SEAPLANES AS COMPILED BY *AVIATION*

ON DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

y and corrections and suggestions are invited

Performance with Full Load at Sea Level as Supplied by Manufacturers																	
High Speed in M.P.H.	Cruising Speed in M.P.H.	Landing Speed in M.P.H.	Climb at Sea Level in F.P.M.	Climb to 10,000 in Minutes	Service Ceiling in Feet	Fuel Capacity in Gallons	Normal Range in Miles	Normal Fuel Consumption at Cruising Speed Gal. Per Hr.	Fuselage Construction	Wing Construction	Are Wings Wired for Lighting	Type of Control	Brakes	Type of Shock Absorber	Dept. of Commerce Type Certificate Number	Performance Figure Guaranteed	
96	85	55			15 000	40	450	8	Wl-ST	Wd F	Yes	SFD	Ex	O-S	13		Advance—Waco 90
155	118	40	1 300		18,000	65		12	Wl-ST	Wd F	Yes	SFD	Ex	O-S	41		Advance—Waco 220
110	100	38	600		12 000	44	460	6 6	Wl-ST	Wd F	Yes	SD	B	Arl	Apl	Yes	Aero-Craft—Coupe
130		39	1 080		17 000				Wl-ST	Wd F		SCD		RC	56		Alexander—Eaglerock A-1
100	80	34	514		11 500	46	455	10 5	Wl-ST	Wd F		SCD		RC	7	Yes	Alexander—Eaglerock A-2
121		40	840		14 700				Wl-ST	Wd F		SCD		RC	58		Alexander—Eaglerock A 5
125	100	40	1,050		18 500	33	425	8	Wl-ST	Wd F	Yes	D	Yes	R	Apl		
101	85	50	575	45	12 000	42	425	7.5	Wl-ST	Wd F	Yes	SFD	Ex	RAR	17	Yes	American Eagle
105		36	890		15 200				Wl-ST	Wd F		S		RC			Arrow—Sport
250	110	45	1 100	12	16 000	170	500	52	Wd P	Wd F	Yes	DeCD	S-R	Hy-C		Yes	Bach—Air Yacht
128	110	46	850		13 000	92	800	10	Wl-ST	Wd F	Yes	SCD	Yes	RC	47		Bellanca—CH
105	85	41	430	40	15 000	37	400	8	WCST	Wd F	Ex	SPD	Ex	O-S	36	5%	Berliner—CM-4
136	110	45				40	550	12	Wl-ST	Wd F	Ex	SPD	E	O-S	Apl	5%	Berliner—CM 5
90	80	30	460	60	10 000	55	325	9	Wl-ST	Wd F	Yes	SC PD	Ex	RC	Apl	Yes	Bird Wing—No. 6
132		52	800	16 5	15 100	140		25	Wl-ST	Wd F	Yes	S	S	O	27		Boeing—40-B
129		50	800	25 3	12 000	140		20	Wl-ST	Wd F	Yes	S	S	O	54		Boeing—40-C
115		59	1 000	18 5	12 000	80		20	Wd	Wd F	Yes	De					Boeing—B 1E
95		52			12 000	40			Wd	Wd F	Yes	DeD			23		Boeing—B 1D
110	95	40	650		14 000	45	800	6.5	Wl-ST	Wd F	Yes	SFD	Op	RD	134	5%	Bourdon Kitty Hawk
130	115	43	900		15 500	80	550	9 5	Wl ST	Wd F				RC			Breese
120	95	50		45	15 500	70		15	Wl-ST	Wd F	Yes	SC	Yes	OS	33		Buhl Airsedan
139	115	45	600	15	14 000	90	700	14	Wl-ST	Wd F	Yes	SP	Yes	OS	46	5%	Buhl Special Airsedan
110	90	40	800	25	11 000		600	7	Wl-ST	Wd F	Yes	SP	Yes	OS	Apl	5%	Buhl Junior Airsedan
125	110	45—50	1,000			42	400	10	Wl-ST	Wd F	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co.
125	115	45	1,000			42	400	10	Wl-ST	Wd F	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co
150	125	45—50	1 600			42	400	12	Wl-ST	Wd-PF	Yes	SPD	Ex	RAR	Apl	5%	Cessna Aircraft Co
104	85	36	550		10 000		400		Wl ST	Wd PF	Yes	S	No	RC	53		Command Aire
101	85	46	600		11,500	50	607	7	Wl ST	Wd FD	Yes	S-FC	No	RAR	40	5%	Curtiss—Robin
99	90	38	700		10,000	75	450	4 5	Wl-ST	Wd-FD	No	DSFC	No	RC	Apl.	5%	Davis—V-3
85	75	46	560		15 000	15	375	5	Wl-ST	Wd-FD	Yes	SC	No	RAR	15	5%	Driggs—Dart II
90	80	25	590		10,000	20	600	4	Wl ST	Wd F	Yes	SC	No	Elast			Elias—Aircoupe
105	90	40	700		10 500	20	425	5	Wl-ST	Wd F	No	SC	Yes	OS	Apl	Yes	Fairchild—21
120	104	50	600		12,800	20	600	12	Wl-ST	Wd F	Yes	SC	Yes	OS	Apl	Yes	Fairchild—41
138	110	55	1 050		17 500	160	800	21	Wl-ST	Wd F	Yes	SC	Yes	OS	89	Yes	Fairchild—71
125	105	40				84	750	10	Wl ST	Wd	Yes	SC	Yes	Arl			Federal Aircraft—CM-1
111	90	55	950		16 000	24	350		Wl-ST	D Wd-F		SPD	No	O	122		Fleet Model 1
126	105	46	850		14 000	78	650	12	Wl-ST	Wd P	Yes	SCD	Yes	RC	Apl		Fokker Universal
158	118	54	1,000	15	18 000	126	755	20	Wl-ST	Wd P	Yes	SCD	Yes	RAR	52	5%	Fokker Super Universal
140	118	55	1,400	10	18 600	360	265	90	Wl-ST	Wd P	Yes	DeCD	Yes	RAR	96		Fokker—F 10
115	96—95	37	750	18	16,000	64	680	12	DR F	Wd F	Yes	SCP	Ex	O-S	107	5%	New Stand. Aircraft Corp.—D-24
118	90	40	650		12 150	42	540		Wl ST	Wd F	Op	S	B	RC	117	Yes	General—Aristocrat
135	115	50	950	20	16 600	148	600	21	D-cor	D-cor	Yes	De	Yes	Arl		5%	Hamilton—H-45
140	120	55	1,000	16	18 600	149	600	23	D-cor	D-cor	Yes	De	Yes	Arl		5%	Hamilton—H-47
70	65	32	700			5 5	120		R ST	Wd F	No	SC	No	RC			Heath—Parasol
100	87	35	600		10 500	40	450		Wd	Wd F	Yes	S	Ex	O	35		International—F 27
125	110	40	850		14 000	67	600		Wd	Wd F		S	Stl	O	Apl		International—F 18
95	85	46	650	35	11 600	65	600	12	ST D	Wd F	Yes	DeD	No	OC	Apl	5%	Ireland—Neptune
96	75	28	600	65	12 600	8	500	1 7	Wd	Wd-F	Yes	SC		RC		6%	Irwin—M T F
151	150	57	1 450		17 400	500	750		Wl-ST		Yes		Yes	O			Keystone—Patrician
132		57	570				500		Wl ST	Wd F							Keystone—Pathfinder
102		34	540		12,000		600		Wl-ST	Wd F	Ex	SD	No	RC	19	5%	Kreider Reisner—Challenger
150		40	1 550	10		80	800		DT S	Wd F		SPA					E M Laird—Commercial
190		55	600			42	500		Wl ST	Wd F					28		Lincoln—Page
155	110	50	1,000	16	15 600	100	700	10	W mon	Wd F	Yes	SC	H	RC	Apl	5%	Lockheed—Vega
167	135	55	1 460	10	17 250	100	1 000	18	W mon	Wd F	Yes	SC	H	RC	Apl	5%	Lockheed—Air Express
130	105	55			15 000	140	550	28	Wd D	Wd-F-D	Yes	DeD	No	H	90		Loening—Amphibian
126	108	49	1 000		16 000	83	750	10—11	Wl-ST	Wd-F		SC	E	Grs	25	Yes	B F Mahoney—Ryan B1
135	115	48	600		18,000	150	1 000	21	Wl-ST,D	D	Yes	DDeCF	E	Arl		5%	Allmetal Flamingo
90	75	55	700						Wl-ST	Wd F	Yes	S Pl		RAR			Mono Aircraft—Monocoupe
100	85	55	650		10 000	22	550	4 6	Wl-ST	Wd F	No	S Pl	No	Grs	95	Yes	Mohawk—Pinto
105	90	59	650	25	13 500	42	465	7	Wl-ST	Wd F	Yes	SFD	Yes	F	Apl	Yes	Paramount Cabinaire
120	90	55	500		12 500	38	402	9	Wl-ST	Wd F	Ex	SPD	Ex	RC	36		Pheasant—H10
136	105	45	1 000		11 000	40	600		Wl ST	Wd F	Yes	S	Yes	Arl	19	5%	Pitcairn—PA 5
128	110	45				26			Wl-ST	Wd F	Yes	S		Arl			Pitcairn—PA-6
101	82	45				35	600		Wl-ST	Wd F		S		Grs			Pitcairn—PA-4
114	96	50	750		12 000	110	540	17	D-cor	D-cor	Yes	DeDC	Yes	F			Prudden—S-E 1
95		45				42			Wd D	Wd F		DeCP					Richmond Airways—Sea Hawk
122	112	50	650		15 000	370	790	50	DOR B	DOR, B		DeD	Hy	RDO	Apl	5%	Sikorsky—S37
125	110	55	600	15	19 600	200	500	36	Wd D	DOR E	Yes	DeD		DOS	60	5%	Sikorsky—SM Amphibian
125	110	40	1 600	17	16 600		1 250	5 5	Wl-ST	Wd-F	Yes	S				5%	Simplex—Red Arrow
104	95	50		15 600		40	400		Wl-ST	Wd F		SD		HyC			Starling
118	90	38	625		12 000	50	500	7	Wl ST	Wd F	Yes	PC	St	RHy	Apl	5%	Stearman—C-3 K
150	110	41	1 000		18 000	65	620	11 5	Wl-ST	Wd F	Yes	PC	St	RHy	Apl	5%	Stearman—C-3 R
125	105	56	800		14 000	90	750	11	Wl ST	Wd-F	Yes	DeD	Stl	Hy	74		Stinson—SM-1 D
110	90	46	500		15 500	42	500	7	Wl-ST	Wd F	Yes	DS	Stl	Hy	48	5%	Stinson—Junior
115	100	57	800	12 5	15 000	50	800	8	Wl-ST	Wd-F	Yes	DS	No	RC	73	Yes	Spartan—C 3
114	100	55			14 000	235	540	50	D-cor	D-cor	Yes	DeD	St	O			Stout—Ford—4AT
100		55	600			36	500		Wl-ST	Wd-F				RC	21		Swallow—Commercial
90	80	50	600		11 000	10	560		Wl-ST	Wd-F		SC	No	RAR	Apl		Szekely Flying Dutchman
110	100	58	650			90	500	6	Wl-ST	Wd F	Yes	SP		RAR		Yes	Taylor Bros.—Chummy
						50			Wl-ST	Wd F		S					Texas—Temple
						120			D-cor	D-cor		De		Grs			Thaden Metal—T-1
100		42			12 000	42	410	8	Wl-ST	Wd F	Yes	SPC	No	RC	30		Travel Air—6000
150		45			20 000	60		12	Wl-ST	Wd F	Yes	SPC	No	RC	32		Travel—4000
128	107	50	700		15 500	78	650	12	Wl ST	Wd F	Yes	DeD	Yes	O	Apl		Travel Air—9000
115	100	45	600	27	14 000	52	500	6 4	Wl ST	Wd F	Yes	SPD	Yes	OS	119		Wallace—Touroplane-Model "B"
97	90	55	600		14 000	40	550	8	Wd WlS	Wd F	No	S		C	Apl	5%	[illegible]—Humming Bird
95	85	30	800	20	12 000		500	8	Wl-ST	Wd F	No	SC D	No	RC	No	5%	Western—King Bird

AND WING CONSTRUCTION
P —Plywood cover
R —Riveted
S —Steel
T —Tubing
Wd —Wood
Wl —Welded
L —Lockheed
O —Optional
S —[illegible]
Std —Standard

LIGHTS
N —Navigation lights
Op—Optional

CONTROL
A —Areas
C —Cables
D —Dual
De—Wheel
P —Push rods
S —Stick
Pl —Pedal

SHOCK ABSORBER:
Arl —Aerol
C —Cord
D —Compression
Grs —Gruss
Hy —Hydraulic
O —Oleo
P —Pneumatic
R —Rubber
RAR—Rusco Aero Rings
S— —Coil Spring
T —Trombone

TYPE CERTIFICATE
Apl—Applied for and is pending
GUARANTEE
N —New

MANUFACTURERS' SPECIFICATIONS ON ENGINES AVAILABLE FOR COMMERCIAL USE AS COMPILED BY *AVIATION*

THE TABLE BELOW IS BELIEVED TO BE ACCURATE BUT *AVIATION* DOES NOT ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

This table will appear monthly and corrections and suggestions are invited

Manufacturer or Agent	Engine	Cooling System	Cylinder Arrangement	No. of Cylinders	Cycle	Propeller Drive	Rated Hp. and R.P.M. at Sea Level	Maximum Hp. and R.P.M. at Sea Level	Weight Dry Without Hub or Starter	Weight Per Rated Hp.	Bore and Stroke (In.)	Compression Ratio	B.M.E.P.	Displacement (Cu In.)	Frontal Area (Sq Ft.)	Diameter of Mounting Ring or Distance Between Bearers (in.)	Height or Overall Diameter (in.)	Length Without Starter (in.)	Guaranteed Fuel Consumption at Rated Hp Lb./Hp. Hr	Oil Consumption Lb./Hp. Hr	Valve Mechanism	Cylinder Construction (See Key)	No. Intake Valves Per Cylinder	No. Exhaust Valves Per Cylinder	Make Spark Plugs Supplied with Engine	Type of Ignition	Make Ignition	No. Carburetors	Make Carburetors	Make Starter	Are Exhaust Manifolds Provided	Shipping Weight Crated	Dept. of Commerce License	Cost at Factory
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AVIATION

The Oldest American Aeronautical Magazine

June 15, 1929

AERONAUTICAL ENGINEERING SECTION

CONTENTS

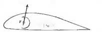
Analysis of the Wing and Other Indeterminate Structures

By Jean Fradiss and Armand Thieblot
Fokker Aircraft Corporation

Introduction

EVERY system in which the external reactions given by the supports, or the loads in the internal members, cannot be determined by an elementary distribution of given forces i e, by the rules of statics, is called a statically indeterminate system

Most of the systems that the aeronautical engineer has to analyze are statically indeterminate The conventional type of wing structure forms a system that is not statically determined if all the elements taking a part of the load are taken into account the spars, ribs, compression members drag truss, and often the skin The tail surfaces with their external bracing, the conventional engine mount made of welded steel tubing, the nacelle structure and nacelle bracing, etc, are generally not statically determined The elementary method that consists of distributing the loads according to the rules of statics—regardless of the elastic properties of the structure considered, i e, by writing graphically or analytically



the equations of equilibrium, is insufficient for most systems It is then impossible to determine the reactions and therefore to analyze this system with exactitude

In most cases the engineer either will make dangerous assumptions based on a more or less arbitrary distribution of loads, which must be absolutely prohibited in airplane design, or will choose sizes for the different members which are considerably overstrength which does not give an efficient structure.

In order to analyze indeterminate airplane structures it is necessary not only to consider the geometrical properties of the systems so far as the laws of Statics are concerned, but also to make due allowance for the elastic properties of the systems in so far as the principles of strength of material are involved

The fact cannot be emphasized too strongly that the analysis of the above systems is not at all complicated or tedious but very easy, provided a method has been developed for each particular case, and this is the purpose of these articles,

We will first analyze a wing structure of the conventional type made of two spars compression members and a drag truss, with a fabric cover Then we will consider the same wing in which the fabric cover and the drag truss are replaced by a rigid cover—such as

Jean Fradiss was educated at Paris University (Sorbonne) and graduated with degree of Master of Science He specialized in aeronautics and completed the course as Aeronautical Engineer from the Ecole Superieure d'Aeronautique

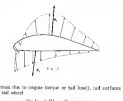
Shortly after he entered the French Military Service, later obtaining a commission as Flight Lieutenant in the Reconnaissance Division, 33rd Regt

After two years of flying he entered commercial work and passed two and one-half years in exhaustive technical research during which time he solved many difficult structural problems Since joining the Fokker organization as chief structural engineer under Alfred A Gassner, chief engineer, he has perfected new methods of structural calculation

This article and several others have been prepared by Mr Fradiss in collaboration with Armand Thieblot of the Engineering Department, Fokker Aircraft Corporation

plywood or duralumin We will end this study of the wing by indicating a very simple method for calculating any type of wing structure

Then we will analyze other common indeterminate systrms, such as the engine mount, fuselage structure,



(torsion due to engine torque or tail load), tail surfaces and tail wheel

Study of Wing Structures

We will begin the analysis of wing structure by explaining two considerations that will simplify the problem and on which the following methods are based They will

be used in the calculation of wings considered as indeterminate structures The first consideration refers to aerodynamics and the second one to the strength of materials

They are:

1—The Focus of an airfoil section

2—The Elastic Center of a wing section

1—*Focus of an airfoil section* and influence of the moment coefficient in the choice of an airfoil section.

Theorem:

For every airfoil section, there exists a point for which the moment is independent of the angle of attack

This point is called the "Focus" of the section (Fig 1) The moment, about the focus, constant with the speed, is nothing but LC_{m0}, that is the moment when the lift $= 0$ (L being the chord and C_{m0} the moment coefficient when $C_z = 0$)

Proof [1] The air acting on the upper and lower surfaces of the wing may be represented by two forces, respectively, R_1 and R_2 as shown in Fig 2, which are functions of the angle of attack Generally these two forces have not the same line of action and the resultant of all the air loads on the wing section may be replaced

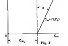


Fig 3

by a force and a couple which will vary with the location of the point of application of the force, and with the angle of attack We will demonstrate that there is a point for which the moment is constant

Let us call λ the position of the center of pressure, for a certain angle of attack i, expressed in per cent of the chord

$$\lambda = \frac{d}{L}$$

Where d is the distance from the center of pressure to the leading edge and L the chord

The moment coefficient is given by the expression

$$C_m = \lambda\,(C_z \cos i + C_x \sin i)$$

The curve showing the variations of C_m as a function of C_z is generally very nearly a straight line (see Fig 3) Therefore we may write,

$$C_m = C_{m0} + aC_z$$

and the moment is

$$LC_m = LC_{m0} + LaC_z$$

It can be seen that the expression giving the moment contains two parts LC_{m0}, which is constant and independent of the angle of attack, and aLC_z

[1] *If American engineering units are used instead of absolute units, transformation factors should be applied to the coefficients in the following equations*

It is evident that if we choose for the point of application of the force, a point located at a distance from the leading edge equal to aL, the moment with respect to this point will be constant and equal to LC_{m0}.

A more rigorous proof of the above theorem, based upon higher aerodynamical considerations, would be outside of the scope of this paper

The selection of an airfoil section is guided by the choice of certain coefficients that characterize the aerodynamic properties as well as the structural qualities of the airfoil considered

Their relative importance depends upon the particular case considered nevertheless they are generally listed in the following order

a—maximum lift—(C_z max.), which enables the plane to carry the maximum load per square foot at a given minimum speed

b—fineness at cruising angle $\left(\frac{L}{D}\right)_c$, that requires the minimum thrust at this angle

c—thickness ratio and camber of centerline—so important in the cantilever type of construction in giving to the spars enough depth at the wing root, and to both spars a similar depth

These three important considerations can be found in all aerodynamic data on wing sections

But there is another very important factor that is generally not given with those listed above:

d—the moment coefficient at zero lift (C_{m0}) which is connected with the travel of the center of pressure

The usual curve of the position of the center of pressure against the angle of attack does not show well enough consequences of the displacement of the center of pressure on

1—the aerodynamical characteristics

2—the stability

3—the distribution of the loads on the wing structure

But these can be easily found in determining the moment coefficient of the airfoil section at zero lift

The calculation of C_{m0} consists of plotting.

$$C_m = \frac{d}{L}\,(C_x \sin i + C_z \cos i)$$

and C_z against i, and reading C_m for $C_z = 0$ The curve of C_m is usually very nearly a straight line

We will consider here the influence of C_{m0} only so far as its influence on the wing structure is involved, since our purpose is the analysis of the structure

Generally the airfoil sections having a great center of pressure travel have a high C_{m0} The torsional moment in the wing is evidently proportional to C_{m0}

And according to the theorem demonstrated above, it is possible to determine the torsion in the wing in calculating the moment about the Focus of the airfoil section, or the resultant focus of the wing if different airfoil sections are used

If the wing is designed in such a way that the center of elasticity the definition of which is given below coincides with the focus the torsion of the wing is equal to the constant moment LC_{m0}, if these two points do not

coincide, the torsion is equal to the above constant moment minus the moment of the resultant passing through the focus about the elastic center.

The moment, being as shown in Fig 4, increases the reaction on the rear spar and decreases the reaction on the front spar. (But this does not mean that it is always correct to transform arbitrarily the moment into two vertical forces acting at the spars, because generally the direction of these reactions depends upon the entire wing structure and can only be determined with exactitude if every element taking a part of the load is taken into account.)

If the airfoil section chosen has a small displacement of the center of pressure it has a small torsional moment; which means not only better aerodynamic characteristics

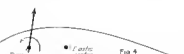


Fig 4

and inherent stability, but also lighter spars (especially the rear spar), lighter compression members or skin, whichever absorbs the torsion in the wing structure.

2—Elastic Center of a Wing Section

The spars, ribs, drag truss or rigid covering form a unit structure and therefore it is not correct to treat any of these elements separately.

It is dangerous to calculate each spar alone, and then to make assumptions to determine the loads in the compression members, unless these assumptions are checked by a test to destruction—which is very expensive for large wings.

The system being generally not statically determined can be solved only by the elasticity method.

In most cases, each spar is correctly analyzed and whenever there are more than two points of support the well known equation of three moments is used, or the

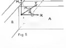


Fig 5

deflections calculated. These two methods are correct since they refer to the elasticity of the spar.

But the first one, the three moment equation, cannot be used with accuracy in the general case where the inertia varies along the span, and when the neutral axis is not a straight line.

The mistake generally made is distributing the loads in the wing structure more or less arbitrarily and computing the stresses, as if each element were independent of the others, and neglecting the torsional moment, etc.

The general precise method for analyzing a conventional wing structure is long and complicated.

The following method is not quite as rigorous, but is considerably shorter and easier.

For each wing section, a point may be determined such that a load applied at this point causes equal deflection on the two spars.

If a rigid covering is used, the wing structure may be considered as a four-wall box beam the walls being interconnected by the ribs, so that, if the ribs are stiff enough, each section retains its original form in torsion. A point may be determined such that a load applied at this point causes equal deflections of the two horizontal walls and equal deflections of the two vertical walls.

We will call this point the "Elastic Center" of the section.

It is located at distances from the spars or walls inversely proportional to their moments of inertia. As a matter of fact, for a certain wing section, the location of the elastic center depends upon the variation of the moment of inertia of the spars between the fuselage attachments and the section considered, as well as the length of the spars if the two spars have not the same length—but generally this may be neglected, and the elastic center determined separately for each wing section.

Any load on the wing structure may be replaced by a load acting through the resultant elastic center of the wing and a couple, or resultant torsional moment. The airload, for instance, may be replaced by a load acting at the elastic center and a couple applied at the spars (which creates shearing stresses in the covering if a rigid covering is used), while the load which passes

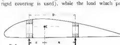


Fig 6

through the elastic center is distributed between the two spars and causes a bending moment and a secondary torsional moment in each spar.

We will now show by a concrete example how the elastic center may be used in the analysis of any wing structure. We will first consider the case of the conventional type.

A—Conventional Type

We will analyze a cantilever wing structure of a conventional type—that is a wing made of two spars, ribs, a drag truss, compression members and a fabric cover.

The purpose of this analysis is

1—To give a better method for distributing the airload between the spars.

2—To give a method for calculating the compression members.

The usual way of analyzing a wing structure is based on two opposite assumptions

1—The resultant of the airload is broken up into two parallel components applied at the spars, according to the location of the center of pressure, and regardless of the rest of the structure. Therefore the wing structure is assumed to be infinitely rigid.

2—Then each spar is isolated and calculated as a beam; the three moment equation is used to determine the reactions or the deflections calculated, which means that the spar is no longer considered as being rigid, but is treated as an elastic system.

These two hypotheses are in contradiction.

In the method outlined below, the loads will not be distributed by regarding each spar as a separate unit, but according to the elastic properties of the wing structure considered as a whole. This is due to the fact that the presence of the transverse members changes the distribution of the external loads, because they transmit a part of the load from one spar to the other, having thus a relieving effect which is a function of their own elasticity. Thus it is seen that the drag struts in a wing have a two-fold task: first, to take care of the drag loads, and second to provide a certain amount of torsional rigidity in maintaining the original form of each cross section of

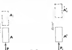


Fig 7

the wing by equalizing the deflections between the spars.

And this important feature of the inter spar structure should be taken into consideration in the distribution of the external loads.

Arbitrary Methods

The spars are treated separately. There is no way of computing the loads in the compression members. The Air Service and Department of Commerce require a margin of safety of 33 per cent and that the axial load on the drag strut be assumed to act with an eccentricity equal to one-sixth of the spar depth.

Exact Method

The reactions at the fuselage attachments and at each compression member have to be determined.

The force and the moment which make up the reaction of the drag member A on the spar B (see Fig 5) give six unknowns:

X, Y, Z are the projections of the force on three axes of co-ordinates and M_x, M_y, M_z, the three projections of the vector representing the moment.

The components X, Y, M_x, M_z, having a negligible

Fig 8

influence on the vertical deflections of the spars, may be neglected.

Besides for each drag member the reactions on the front spar are equal to the reactions on the rear spar.

Therefore we have only two unknowns per drag strut: a vertical force Z and a moment having its axis parallel with the spar axis M_y.

The number of unknowns in the system spars drag members is $2n + m$, where n is in the number of drag members, m the number of unknowns at the wing attachments of the spars. We have only six equations of equilibrium. Therefore the system is generally not statically determined.

The exact method consists of writing the equation of least work for the complete system and deriving this equation with respect to each force and each moment in order to get the number of equations necessary to solve the system, that is $2n + m - 6$. This equation is:

$$\Pi = \tfrac{1}{2}\int_0^l \left\{\frac{M_x^2}{EI} + \frac{M_y^2}{EI} + \frac{M_z^2}{GI} + \frac{F_x}{E\Omega} + \frac{F_y}{G\Omega} + \frac{F_z}{GE}\right\} dl$$

Method Based on the Deflection

It is much easier to compute the deflection of each spar separately; it is then possible to determine, by means of the rule of "Reciprocity" of Maxwell, the load in the compression members due to the difference of the deflection of the two spars since these members cause the two spars to deflect together.

But even this method generally gives long and tedious calculations.

Method Based on the Elastic Center

The consideration of the Elastic Center will simplify the problem very much. Let E be the Elastic Center defined as above. The distance from the Rear Spar to the Elastic Center is, with sufficient accuracy:

$$a = \frac{I_f}{I_f + I_r} D$$

Where D is the distance between spars
I_f the moment of inertia of the front spar
I_r the moment of inertia of the rear spar.

Referring to Fig 6

Let P and P_1 be the external loads acting on each spar (calculated by the approximate method, that is sup-


Fig 9

posing the wing rigid and distributing the resultant airload between the spars into two components inversely proportional to the distances to the center of pressure.)

Let d be the distance from the front spar to the Elastic Center.

Under the loads P and P_1 the front and rear spars will deflect and take positions A_1 and A'_1. (See Fig 7).

If we replace these loads P and P_1 by a Force $F = P + P_1$ and a moment M acting at the elastic center, the force F will give to the spars equal deflection and therefore will not induce any load in the drag members which have only to transmit the moment M.

The force F applied at the elastic center may be broken up into two components, which will give two forces P' and P'_1 acting respectively on the front and rear spars. The difference of the loads applied on the spar (that is, for the front spar, the difference between the load P, computed as outlined above; and the component P' of the force F which is really the load acting

on the spar) is the reaction of the drag member We can make the calculations as follows

Load really acting at the rear spar

$$L_1 = (P + P_1)\frac{d}{D}$$

Load really acting at the front spar

$$L = (P + P_1) - (P + P_1)\frac{d}{D}$$

$$L = \frac{(P + P_1)(D - d)}{D}$$

Drag member reaction (see Fig 8)

$$B = P_1 - (P + P_1)\frac{d}{D}$$

$$A = P - \frac{(P + P_1)(D - d)}{D}$$

or

$$B = \frac{P_1 - (D - d) - P d}{D}$$

$$A = \frac{P_1 (d - D) + P d}{D}$$

$$A = -B$$

The moment of these forces is equal to the moment acting at the elastic center

Hence we have all the elements necessary to compute the stress in the drag member, which takes in bending the torsional moment of the air reaction

The load was distributed between the two spars by the normal method, but the calculation may also be made as follows

Let L be the air reaction acting at the focus of the airfoil section and M_1 the moment, o the distance between the focus and the elastic center, we have at the elastic center (see Fig 9)

$$\text{Force} = L\,K$$

$$\text{Moment} = (M_1 - Lo)\,K$$

(Because L is nearly perpendicular to the chord direction K being the load factor)

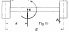


Fig 10

If D is the distance between the spars we have moment

$$M = (M_1 - La)\,K$$

Reactions of Drag members on the spars (see Fig 10)

$$B = -A = \frac{(M_1 - La)\,K}{D}$$

True load on the front spar =

$$\frac{L\,(D - d)\,K}{D}$$

True load on the rear spar =

$$\frac{L\,d\,K}{D}$$

It can be seen that these values are equal to the true loads on the spars determined above by the first method.

The second of these articles will appear in the July 20 issue of the Aeronautical Engineering Section

TECHNICAL PUBLICATIONS RECEIVED

N A C A Technical Note No 305—Corrosion Embrittlement of Duralumin, VI The Effect of Corrosion Accompanied by Stress on the Tensile Properties of Sheet Duralumin, by Henry S Rawdon, Bureau of Standards

N A C A Technical Note No 306—Curves Showing Column Strength of Steel and Duralumin Tubing, by Orrin E. Ross

N A C A Technical Memorandum No 512—Contribution to the Technique of Landing Large Airships, Part I, by O Krell, from Zeitschrift für Flugtechnik und Motorluftschiffahrt, September 28, 1928

N A C A Technical Memorandum No 513—Contribution to the Technique of Landing Large Airships, Part II by O Krell, from Zeitschrift fur Flugtechnik und Motorluftschiffahrt, September 28, 1928

N A C A Technical Memorandum No 514—Technical Report of the 1928 Rhön Soaring-Flight Contest, by A Lippisch from Zeitschrift für Flugtechnik und Motorluftschiffahrt, February 14, 1929

Air Corps Technical Report No 2919—Determination of Structural Airplane Drag

Air Corps Technical Report No 2918—Dynamometer Carburetion Runs on Curtiss GV-1570 engines

Air Corps Technical Report No 2879, the Consolidated PT-3 Airplane Wing Cellule in Low and High Incidence

Air Corps Technical Report No 2943, Comparison of Wind Tunnel Tests with Flight Tests on a Number of Detachable Balde Propellers made from the some Plan

Royal Aeronautical Society Lecture—French Wind Tunnel Methods, by Monsieur A Lapresle, Director of the "Eiffel Laboratory", Aeronautical Engineer, Dr of Science

N.A.C.A Technical Memorandum No 507—Landing and Braking of Airplanes by Louis Breguet, From Supplements to Nos 8 and 9, 1928, of La Chronique des Avions Breguet

N.A.C.A Technical Memorandum No 508—Aeromechanical Experimentation (Wind Tunnel Tests), by R Katzmayr, From Luftflotten, 1928

Royal Aeronautical Society—The Lubrication of Aircraft Engines, by F A Foord, A F.R Ae S

National Conference on Weights and Measures—The Solution of Air in Gasoline, paper by Dr Oscar C Bridgeman, Research Associate at the Bureau of Standards for the Society of Automotive Engineers

General Electric Review—Aircraft Compass Problems—by T R Rhea, Marine and Aircraft Engineering Department, General Electric Company

Notes on the Design of Ailerons

By Lieut. H. A. Sutton
U S Army Air Corps

A STUDY of the control surfaces being used on many of the recent airplanes shows a general lack of appreciation of the importance of providing the best obtainable control characteristics The continued use of inferior designs may be due partly to the necessity of depending principally on empirical data and experience because of the absence of any satisfactory design theory

Under such circumstances, it is important that the information gained from all sources be made readily available Proper use of a wind tunnel during the early stages of a design would correct many of the errors of judgment which occur, and it is to be regretted that more use is not made of wind tunnels before large sums are spent in building new designs A large proportion of the accidents now occurring could be prevented by improvement in controls and few things are more reassuring to the pilot in a tight situation than confidence in his ability to maintain control Blaming the pilot for an expensive accident does not repair the airplane while even a slight improvement in controlability might have prevented the occurrence of such an accident

Control System Should be Simple

The design of aileron controls is particularly susceptible of improvement on many airplanes Certainly nothing is more exasperating to a pilot than trying to operate a stiff and ineffective aileron control in rough air Aileron controls should be simple in construction A complicated system of pulleys and bell cranks may show ingenuity in avoiding interferences but such systems are never satisfactory in operation because the excessive friction, wear in the numerous joints and general slackness which soon occur in service cannot be satisfactorily corrected The right and left ailerons


A photograph showing the aileron on a Boeing P-12 Pursuit Plane

should be connected independently to the operating control so that failure of one side will not cause a total loss of lateral control Aileron control horns should be so located that excessive wing deflections will not be caused by aileron loads and the control system should be so arranged that it is not affected by deflections occurring in the airplane Bearing surfaces on all joints should be larger than is usual in present airplanes and should be easily lubricated

The lateral control should be effective at low speed particularly during landing and take-off without being hard to operate at either low or high speeds This is generally hard to accomplish especially on large airplanes without the use of some type of balance It is well known that aspect ratio is important in securing aerodynamic efficiency, and it is obvious that the aileron should be kept as far as possible from the longitudinal

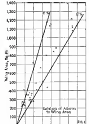

Lower and upper views of the aileron of a Thomas Morse observation airplane

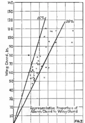
axis The aileron area required depends on these factors among others, but experience has shown that ailerons should have between 6 and 12 per cent of the wing area. For large airplanes whose lateral mass distribution is increased relatively by placing engines in the wings the ratio should be more nearly 12 than 6 per cent. This assumes that a good plan form is used as many of the old designs required more than this amount. Small airplanes with tapered wings require less aileron area, but very few airplanes have good lateral control with less than 6 per cent Fig 1 shows the proportions in use on a number of representative airplanes

The chord of an aileron should not be less than 15 per cent of the wing chord. A shorter aileron chord results in a loss of rolling moment obtainable for a given area and a very great increase in aileron chord increases the hinge moment and adverse yawing moments. The results plotted in Fig 2 indicate that the normal limits are from 15 to 25 per cent. Adverse yawing moments can and should be eliminated, preferably by use of a differential motion of the aileron control surfaces in which the upward moving aileron has a greater angular motion than the one which moves down. The angular motion should be at least 20 deg.

As the aileron span is increased toward the fuselage it becomes less efficient in producing rolling moments. The ratio of aileron span to distance between the longitudinal axis and the centroid of aileron areas generally varies from .35 to .75, the smaller ratios being more common on airplanes of large wing span and large aileron area. Since movement of the aileron has the effect of changing the lift over that portion of the wing of which it forms the trailing edge, it is important that its span be kept large. Aileron aspect ratios vary between 5 and 11 with a general trend toward reduction in ratio of aileron area to wing area as the aspect ratio increases (see Fig 3). Very long ailerons are liable to cause structural difficulties because deflections either of the wing or aileron cause binding in the hinges

The aileron plan form depends somewhat on the wing plan form. Load distribution tests have shown that rectangular or negatively raked wing tips are subject to high loading at the tips and it is obvious that ailerons should be kept out of such regions. Some typical plan





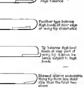
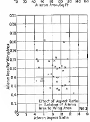
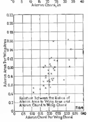


FIG. 5





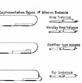


FIG. 6

forms are shown in Fig 5. Ailerons which extend beyond the wing tip are inefficient and cause high local hinge loads. Skewed ailerons are not as satisfactory as those whose hinge axes are approximately parallel to the lateral axes. In general ailerons should be approximately rectangular in plan form.

Aileron balances may be of many types, but in general the Frise balance is most satisfactory. In order to secure satisfactory control characteristics on an airplane the three control forces should be properly proportioned. If one control is twice as easy to operate as another the airplane will be difficult to fly properly. Satisfactory control operation may be secured without the use of balance, but this condition is seldom found (especially on large airplanes) and one of the changes most frequently necessary in an airplane during its experimental development is a reduction of control force. Unfortunately no very satisfactory design criterion exists for determining the amount of balance desirable unless wind tunnel tests are made. The aileron balances in use vary from 15 per cent to 30 per cent of the total aileron area depending somewhat on the type of balance used. Complete balance is of course not desired and the balance effect should be fairly uniform throughout the range of aileron movement and angle of attack so that the pilot will retain a reasonably small positive "feel" of the control. Fig 6 illustrates the various types of aileron balance which have been generally used. Localized

Aileron on a Fokker C 2 transport plane

balances such as the Panther or tip types cause high local hinge loads and are less satisfactory than the Frise or Handley Page types extending along the whole aileron span

TECHNICAL REVIEWS

N A C A Technical Report No 310, Pressure Element of Constant Logarithmic Stiffness for Temperature Compensated Altimeter, by W G Brombacher and F Cordero

The usual type of altimeter contains a pressure element, the deflections of which are approximately proportional to pressure changes. An evenly divided altitude scale is secured by using a mechanism between the pressure element and pointer which gives the required motion of the pointer. A temperature-compensated altimeter was constructed at the Bureau of Standards for the Bureau of Aeronautics of the Navy Department which contained a manually operated device for controlling the multiplication of the mechanism to the extent necessary for temperature compensation. The introduction of this device made it difficult to adjust the multiplying mechanism to fit an evenly divided altitude scale. To meet this difficulty a pressure element was designed and constructed which gave deflections which were proportional to altitude, that is, to the logarithm of the pressure. Mathematically, the logarithmic stiffness S' of the element equals

$$S' = \frac{d \log_e P}{dy}$$

from which is derived the deflection y for the change in pressure from P_0 to P

$$y = \frac{\log_e P - \log_e P_0}{S'}$$

The element consisted of a metal bellows of the "sylphon" type coupled to an internal helical spring which was designed so as to have a variable number of active coils. This report presents a description of and laboratory data relating to the special pressure element for the altimeter. In addition equations which apply generally to springs and pressure elements of constant logarithmic stiffness are developed, including the deflection and the spacing between the coils in terms of the constants of the helical spring and pressure element

N A C A Technical Report No 309 Joint Report on Standardization Tests on N P L R A F 15 Airfoil Model By Walter S Diehl

This report contains the wind-tunnel test data obtained in the United States on a 36 by 6 in R A F 15 airfoil model prepared by the British Aeronautical Research Committee for international trials. Tests were made in co-operation with the National Advisory Committee for Aeronautics at the Bureau of Standards, Langley Memorial Aeronautical Laboratory, Massachusetts Institute of Technology, and McCook Field

In addition to brief descriptions of the various wind tunnels and methods of testing, the report contains an analysis of the test data. It is shown that while in general the agreement is quite satisfactory there are two cases in which it is unsatisfactory. Since the lack of agreement in the latter is probably explained by errors known to be inherent in the methods of determining and applying corrections in these particular tests, it is concluded that the agreement obtained is more a matter of technique than a wind-tunnel characteristic

Development of Welded Aircraft Construction, by S C Clark, Kansas City, Mo, and W I Gaston, New York, N Y

In this paper the authors point out that steel tubing is coming into common use for fuselage construction and with this there is a trend toward general use of welding. It is desirable to establish standard designs for welded joints and to this end further research is needed. Suggestions are made for improvements in welding practice that will add safety and insure uniformly well-made welds

Steel Aircraft Construction in Great Britain

By W. H. Sayers
Boulton & Paul Ltd

Of THE materials commonly used in the construction of aircraft, steel ranks second only to spruce in the extent of its use It is therefore somewhat remarkable that, at a time when the airplane manufacturers of the whole world are turning from timber to metal as their main structural material, only one nation has really seriously tackled the problem of using steel as a substitute for spruce

The statement contained in the above paragraph is perhaps open to some misconstruction In the first place it may be said that steel tube is now accepted nearly everywhere as the normal material for fuselage members, interplane and other struts, and secondly, that the difficulties of using steel in any other form than that of tubes and for members which have to sustain other than end loads are so obvious that it is surprising that anyone should think of attempting it, when the light alloys such as duralumin, offer so much simpler means of achieving the desired result

Fig 1

Fig 2

Fig 1—Dotted line shows effect of bending on the flange in compression Fig 2—Methods of preventing wrinkling of the flange

In Great Britain, however, the problems of producing steel structural members of all the types needed for the building of airplanes has been tackled with such success that today all British military aircraft, experimental types excepted, are of metal construction

The majority of these machines use steel for all the main members, including wing spars, while the light alloys are in general relegated to a secondary role This result has not been accompanied by any excessive structural weight, rather the reverse and it has relieved the Royal Air Force of most of the anxiety as to the effects of corrosion which are generally felt in regard to machines mainly built from the aluminum alloys

The history of this particular development dates back to that period in the War when the difficulties of obtaining silver spruce of the quality and in the quantities required by the Allied Air Services were acute The British capacity for producing duralumin was so limited that the whole production was inadequate to the needs of the Airship constructors alone. The position in regard to steel was much more promising, and it was at first proposed to use solid drawn tubes of high tensile steel Here difficulties of plant, as opposed to material supplies proved insuperable but it was found practicable to develop the production of greatly improved medium carbon steel tubes of 45 or so tons ultimate strength which served in some part to alleviate the position However it was speedily recognized that tubes of no available material would meet the whole of the needs of the aircraft constructor and that for wing spars sections rolled or drawn to shape from thin strip metal promised a way out of the difficulties in question Originally it was proposed to use a steel of the cold-rolled class with an ultimate tensile strength of about 40 tons per sq in and experimental sets of wing-spars and of complete wings were produced and tested with satisfactory results as far back as 1918 In some very early examples of this class hardened alloy steels were used

No machines with steel wing structures were actually put into production during the War The experimental work then carried out proved that such structures could be built to compete in strength and weight with those of normal timber construction and also that the technical problems to be overcome before this type of structure could be adopted generally were of a very serious nature At the same time it was felt that these difficulties were by no means insuperable and that the practical advantages attending on the use of steel for this purpose justified continued work along this line

Encouraged by the Air Ministry some two or three firms have steadily carried on this work of development ever since the end of the War with the result that today steel aircraft structures are the rule rather than the exception among new British Military airplanes

The General Problem of Steel Construction

The problem that has had to be solved in producing the steel airplane is that of making an ultra-light structure of adequate strength in an essentially dense material Taking spruce at 28 lb per cu ft with a maximum permissible stress of 5,000 lb per sq in, steel weighing 490 lb per cu ft must develop at least 88 000 lb per sq in to be able to compete on the strength-weight basis There is no difficulty in obtaining steel which will give an ultimate tensile strength or even an elastic limit of more than this figure, but this is by no means the same thing as developing this effective strength in members of the type required for airplane construction

Where tension loads alone are concerned the specific tenacity of steel is sufficiently superior to that of other materials to have secured its almost invariable use but for members taking end or bending loads, another set of considerations have to be taken into account

For equal weight a steel member such as a hollow strut or box-spar must have walls not more than one-seventeenth of the thickness of those of the corresponding spruce member This means that the steel has to be used in the form of sheet a few thousandths of an inch thick Any attempt to construct sections of the types used in normal engineering practice, of the overall dimensions necessary, is useless as members with such thin walls fail by local deformation of the walls This type failure is closely akin to the failure of a slender strut by buckling under a nominal loading far smaller than that corresponding to the product of the cross-sectional area and the ultimate compression strength of the material

In very general terms, one may regard any narrow strip of such a thin-walled member as an elementary strut, having very little inherent stiffness of its own, but supported by the neighboring elementary strips A series of such elementary strips forming a tape of appreciable width is thus stiffened in the plane of its own width but not in that of its thickness

If both the width and the length of this tape are great compared to the thickness however the tape on edge will not serve as an effective beam The edge in compression will buckle laterally so that the central section is no longer edge-on to the load and a premature failure will result

To overcome this type of failure it is necessary to provide in any beam not only stiffness in the plane of the primary load which it is intended to resist but also either sufficient inherent stiffness in a plane at right angles to this, or some extraneous lateral support To give the necessary lateral stiffness for stability the edge under compressive load may be turned through a right angle, forming an angle section, or a flange strip may be added to form a "Tee" section It will at once be recognized that types of sections commonly used as beams for instance angle "Tee" "I" channel etc all have the characteristic that the material in them is so arranged as to provide not only stiffness in the plane of primary loading, but also an appreciable if lesser degree of stiffness in a plane at right angles to this primary plane

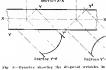


Fig 3—Drawing showing the diagonal wrinkles in the web resulting from shear stresses

It is usual to ascribe the distribution of material found in such sections to the desire to place as much of it as possible at the greatest practicable distance from the neutral axis of the beam where it may most economically resist bending There is ample warrant for such a statement, but quite apart from this, some such forms as are in fact, adopted would be necessary merely to guard against failure caused by lateral instability such as has been described

Consider the case of the "I" section beam in Fig 1 with flanges and webs of very thin material Under bending the flange in compression will buckle at the edges and assume the wrinkled form shown by the dotted lines long before the applied bending moment reaches the value that the ordinary theory of beams would indicate as the failing loading Complete failure of the beam will follow almost immediately after this wrinkling has set in

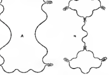


Fig 4—Two common types of construction of sections

To prevent this type of failure it is necessary to stiffen the edges of the webs for example by flanging these edges as indicated in Fig 2 (A)

If the ratio of unsupported width of flange to thickness of web (W/T in Fig 2 A) exceeds a certain limit the flange may still buckle between web and edge the cross-section alternating between the two extremes shown dotted in Fig 2 A and further intermediate stiffening as at B (Fig 2) will be necessary Such stiffening may equally be provided by adopting a longitudinally corrugated form such as shown at C (Fig 2)

Having now satisfactorily stiffened the flanges of the beam it will next be found that under shear stresses the web will develop diagonal wrinkles buckling alternately in opposite directions as shown in Fig 3 where YY and Y'Y' represent the planes of maximum distortion in the two directions This form of distortion again leads to failure under loads much below those which would be indicated by ordinary methods of computation The remedy is again to give to the web increased longitudinal stiffness and similar methods to those adopted for the flanges may be applied

In the production of steel aeroplane spars from thin high tensile strip it is usual to give the necessary longitudinal stiffness by adopting a corrugated form as suggested in Fig 2 C

The simple "I" section there shown is not however a satisfactory one owing to the difficulty of giving adequate stiffness to the overhung flange edges, and it is the almost invariable practice to interpose between successive corrugations curved in the same sense others of opposite curvature

Fig 4 shows diagrammatically two types of construction fairly commonly adopted At "A" is a box section formed from two corrugated web and two corrugated flange strips held together by four rows of rivets At "B" is an "I" section whose flanges take the form of a closed tube. This is built up from seven strips and

has six rows of rivets Neither of these sections can be regarded as really satisfactory samples of good practice

The flanges of "A" are too nearly flat and the section would be improved by raising the central lobe outwards from the center, giving it a form more like that of the flange of "B." "B" is of somewhat awkward shape for the attachment of fittings Neither has been laid out with the necessary attention to insure that the ratio between radius of curvature of the surfaces to the wall thickness will suffice to avoid failure by local buckling above discussed

The individual strips in both these spars can be formed to shape by processes of rolling or drawing which do not involve any change in thickness in the forming This characteristic is essential where the strip is hardened and tempered before forming and extremely desirable even if the material is formed in the annealed condition So far as is known forming processes involving change of thickness are never used in practice on this type of member

The choice between rolling and drawing for the forming process is usually determined by the final shape required Rolling is the quicker and cheaper process because the strip may be brought to the final form by one passage through the rolling mill by using a multiplicity of rolls therein However the finished shape must be such

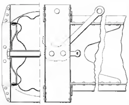


Fig 5—One method of attaching struts and wires to the section shown in Fig. 4A

as to clear the rolls, and hence it is not usually possible to roll corrugations extending over 180 deg or more of arc The outer flange members of Fig 4B could not be rolled because the rolls would foul on the outer corners beside the joints

The cost of either method of forming is not, however, a very serious matter once the necessary plant is available and the tools for the particular section are installed

Almost any grade of steel or of the light alloys may be form rolled or drawn on the same rolls or dies Moreover there is a fairly wide range of gauge thickness which can be formed to the same outside dimensions with the same tools This makes for very considerable economy

The steels most largely used for this type of construction are of the alloy type, which are produced in the form of strip of the finished gauge by the steel makers Until quite recently it was invariable for the strip to be hardened and tempered by the steel makers before forming took place The strip was rolled into a coil and heat-treated in this condition. Considerable variation in the condition was then apt to occur along the length of the same strip which was objectionable, not only on the score of strength, but also because it led to variation in the amount of "spring back" which occurred after leaving rolls or dies

Recently the difficulties of heat-treating the strip after forming have successfully been overcome and the forming can now be done on strip in the fully annealed state This simplifies forming and enables a higher "proof stress" to be attained in the finished member

These methods of forming are not confined to the production of spar components Sections suitable for struts either of streamlined or other shapes may be produced Tubular sections either of the close-joint type or with riveted joints may be produced in high-tensile steel with much higher ratios of diameter to thickness than can be made in the solid-drawn type Certain British tube-makers have achieved remarkable results in producing solid-drawn tubes of hardened and tempered alloy steel but it is by no means easy to insure that such tubes, particularly in thin gauges, shall be true to shape and straight Also such tubes can be made only in comparatively short lengths

Tubes formed from drawn strip hardened and tempered after forming can be produced in any length up to that in which the steel makers can produce the strip, straight, free from variation in wall thickness, and of such accuracy of form that interchangeability of sockets, etc., can be secured

It is thus possible to employ steels of the alloy type for fuselage longerons and other similar purposes in forms which allow full use to be made of their high specific tenacity

To the eye of the engineer not accustomed to this class of work the sections often used in England look to be scarcely practicable for production planes The shapes may appear fantastic and the problems of assembly of such flimsy looking components by means of a multiplicity of small rivets seem almost insuperable Actually the formed components in the steels used are far from flimsy and assembly and riveting can be carried out on semi-automatic machines at high speed and with little skilled labor

Anyone without the accumulated experience acquired by the firms who have developed this type of construction, who attempted to produce satisfactory steel members of this class would undoubtedly find many pitfalls in his way and would need to spend considerable time and much money before satisfactory results could be achieved But with the knowledge now available in England the design of steel airplane structures has definitely passed beyond the experimental stage into that of standard practice

The difficulties are not confined to those of producing satisfactory sections for main members Fittings and joints for any type of aircraft structure present more difficult problems of design than do the main members themselves For the steel framed machine an entirely new technique of detail design has had to be developed

Fittings through which considerable loads are transmitted cannot be attached directly to such thin walled members as are used by merely passing bolts through the members Bolts of excessive diameter would be needed to give reasonable bearing areas Methods of providing local re-enforcement are necessary at points

where concentrated loads are applied to distribute these loads

In normal wooden framed machines large lumps of solid spruce conveniently concealed from sight in the interior of a box-spar are used for similar purposes, and it is not uncommon for designers who overlook this fact to comment on the considerable amount of weight which it is apparently necessary to add to a steel spar for the attachment of fittings The local reenforcement of the steel spar certainly calls for more careful design than does the filling of a spruce spar at joints, but it does not necessarily involve so great an increase of weight

In designing such members as wing spars of the type now being considered it is therefore essential to consider carefully the suitability of the section for the attachment of fittings, and to design standardized types of attachments to meet all probable requirements

In Fig 5 is shown a method which might be used for the attachment of struts and wires to the spar section of Fig 4A

Here a pair of side plates of fairly heavy gauge steel rolled to a section to fit between the lips of the spar are riveted to these lips by the same rivets as serve for the holding together of the flange and web components The side plates are fairly long and have deep "Vee" notches in each end in order to avoid sudden changes in the stiffness of the spar These plates provide the necessary bearing area for two bolts passing through the spar on its neutral axis and tubular distance pieces prevent the crushing in of the side plates by the bolts These bolts secure wiring plates for both lift and drag wires, and also a box, built-up from two channel sides and four flanged bridge pieces. The box serves to attach an interplane strut by a bolt through the upper end of the channels and a drag strut can be fixed between the flanges of the side channels by suitable bolts

Fig 5 is purely diagrammatic in that no attempt has been made to proportion the various components to any likely set of loads It indicates however a reasonably sound method of dealing with the joint problem on a spar of the type shown Moreover the component parts used in this type of joint are all of them such as can be easily made The section of the side plate on the spar can be used for almost any joint likely to be needed on a spar having this particular web section The channel which forms the side of the box is a section that can be used for many purposes and the bridge pieces which complete the box can be combined not only with the channels shown but with other sections which it may be desired to attach to this or any other spar having flanges of the same over-all dimensions.

It will be recognized that having once fixed on a particular spar section to be used very strict limits are imposed on the type of fittings that can be used therewith

For this reason very careful systematization of the work of detail design is necessary in machines of this type When the first experimental machine of a new type is to be built in the usual wood-framed style it is not unusual to start making major structural components long before all of the details have been drawn out and to rely upon fixing up many of the minor fittings "on the job" This method cannot safely be attempted in steel structures of the present type Therefore drawing office work is considerably more expensive than with more conventional structures Moreover if each detail of each new machine were to be considered on its merits and designed accordingly not only would the drawing office costs be very high, but new sections and new tools to produce them would be required for each new type

Thus those firms who have been responsible for this development have been forced to devise complete systems of constructions, which provide for the use of standard sections not only in the main members but also for the fabrication of as many details as possible. The difficulties which have to be overcome are great, and the cost of development has been high, but very marked success has been achieved

For the same useful load and the same strength, the steel framed machine can be made to have an appreciably lower structure weight than can any other type Moreover, if it is within the range of size and general type for which standardized sections and details already exist, it costs less to manufacture than does a wooden framed type

Where any considerable number of machines of the same type are required the overhead charges on the plant necessary and the increased design costs are easily covered and a cheaper and better machine is the result

The methods of manufacture necessary to produce the components practically insure accuracy of dimensions and therefore complete interchangeability of spares Moreover, the characteristics of the material secure freedom from troubles due to warping, shrinkage etc

The Weight of Steel Wings

As it is in the use of steel for wing structures that British practice differs most from that of other nations, it would be of interest here to give figures showing the weights of some representative examples of steel wings Attempts to compare the structure weights of machines of different designs are unfortunately apt to be very misleading, owing to the enormous number of factors which have to be taken into account in instituting a fair comparison and the difficulty is greater when figures for machines produced in one country are to be placed before designers of another country who are used to different methods of analysis, and to different standard requirements as to strength, etc.

Fortunately it is possible to give some figures for a case where wing structures for the same machine designed to exactly the same strength factors have been produced by the same firm

The machine in question is a braced biplane with two bays of bracing on either side, designed for a loaded weight of about 5,000 lb with safety factors, computed according to British Air Ministry requirements, of 6 with forward and 4.5 with backward positions of the center of pressure The top wing has a span of 44 ft and a chord of 7 ft, the lower a span of 44 ft and a chord of 4.5 ft, giving a total area of 464 sq ft The detailed weights of the two sets of wings are —

	Steel	Wood
Spars	168 lb	235 lb.
Drag struts	27 lb.	27 lb
Ribs	72 lb	72 lb
Internal bracing	14 lb	14 lb
Fittings	52 lb	52 lb.
Leading and trailing edges	17 lb	17 lb.
Fabric and dope	81 lb	73 lb
Wing frame total	431 lb	490 lb
Interplane struts	46 lb	62 lb
Center section struts	18 lb	18 lb
External wires	39 lb	39 lb
Total wing structure	534 lb	609 lb

It will be noticed that there is a substantial saving in weight in the spars and in the interplane struts All other items are the same in weight except for fabric, where the steel wings are 8 lb heavier than the wooden

wings This is due to the official requirement that steel ribs should be fabric wrapped to protect the cover from chafing On wings of larger chord a saving in weight would be shown by the steel ribs in fact if this sample were further analyzed it would probably be found that the steel ribs were lighter on the upper wing and heavier on the smaller lower wing than were the corresponding wooden ribs

The net result of the change to all-steel wings is a saving in wing weight of 75 lb and a change of specific weight from 1 3 to 1 16 lb per sq ft for the complete structure

No other comparison quite so complete is at present available but there are available a number of confirmatory cases

Two single seater fighters ("pursuit ships" in American terms) built by another firm weighed, fully loaded 3,040 lb (wood) and 3,050 lb (steel) The weight of the two sets of wings was 392 lb in wood and 324 lb in steel, despite the fact that the safety factors of the steel wings were 8 and 6 as against 7 and 5 for the wooden wings

An attempt has been made in Fig 6 to institute a comparison between the wing weights of machines of all sizes built to British requirements with wood, steel, and duralumin as the main structural material To overcome the difficulty caused by the variation in safety factor called for in machines of different size and intended for different purposes, the actual wing weight has in all cases been divided by the designed factor with center of pressure forward The variation in weight with this factor is not actually linear but within the limits covered by the examples the error involved is not very great The wing weights thus divided have been plotted as a

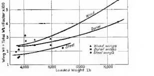


Fig 6—A comparison of wing weights of various craft using wood, steel and duralumin

percentage of total weight against the total weight There is a distinct tendency for the three types of construction to fall on separate curves, and the lowest of these corresponds to the mainly steel machine

The second article by Mr Sayers on this subject will appear in an early issue

PATENTS ISSUED

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Intercrystalline Corrosion of Duralumin

By Frank M. Bondor
Massachusetts Institute of Technology

"AN ARTICLE on 'The Dust Nuisance and Its Elimination" published in the December 12, 1928 issue of Aviation, recommends calcium chloride as a dust-laying agent and states that it is not injurious to materials There is no doubt that calcium chloride is a good dust-laying material but calcium chloride and other chlorides as well as calcium salts promote intercrystalline corrosion of duralumin Flying fields located in a dry climate are usually, to a great extent free from corroding element and therefore the use of calcium chloride on these fields would require that duralumin parts be protected against corrosive conditions

Duralumin, when brought in contact with corroding materials shows a roughened or pitted surface and in addition to this common corrosion, aluminum alloys of the duralumin type are subjected to intercrystalline corrosion The two types of corrosion may occur simultaneously, usually one or the other predominates The Bureau of Standards has found from corrosion tests that wrought alloys containing copper are more susceptible to intercrystalline corrosion than those having the copper replaced by silicon, but this is not true for the common form of corrosion

Impurities Can Be Eliminated

The rapidity of corrosion is in a large extent due to the composition of the alloy, to its heat treatment, and to the percentage of impurities present in the alloy The intercrystalline corrosion due to impurities can be disregarded because the impurities can be entirely eliminated if reasonable precautions are taken

Chemically pure aluminum is very much more resistant to corrosion than any of its alloys, and as the alloying elements are increased the resistance to corrosion is decreased The alloying elements commonly used are copper, manganese magnesium, silicon iron chromium and nickel Overloaded duralumins are those containing alloying elements other than copper manganese magnesium and silicon and they are much more susceptible to the intercrystalline form of corrosion An aluminum alloy containing iron is much more susceptible to intercrystalline corrosion than an alloy that is entirely free from it and the resistance to intercrystalline corrosion decreases as the iron content is increased Chromium and nickel also promote intercrystalline corrosion; of the two elements chromium is much more desirable than nickel in that it helps to refine the grains

Knerr has shown that the resistance to corrosion of duralumin in general is affected by the method of quenching used in the heat treatment The Bureau of Standards investigated this point further and found that cold water quenching rendered sheet duralumin much less susceptible to intercrystalline corrosion than oil quenching or hot water quenching although the mechanical properties in general were scarcely affected by the variation of the quenching media

If duralumin is kept entirely free from corroding materials there is no danger of either common corrosion or intercrystalline corrosion occurring Some materials cause more rapid intercrystalline corrosion than others Samuel found that the action of a 25 per cent solution of sodium chloride potassium chloride or magnesium chloride was very rapid at room temperatures and was accompanied by the formation of bubbles coated with a white film of gelatinous aluminum hydroxide In general all chlorides are the most active in producing intercrystalline corrosion, but calcium salts as well as most acids promote corrosion.

The chemical reactions of the corroding media with the metallic compounds at the grain boundaries are not known, but many theories have been advanced to explain the phenomenon A logical theory is the one advanced by Williams and Homerberg and has been verified in their investigation on the intercrystalline corrosion of steel They believe that intercrystalline corrosion in duralumin progresses in the same manner as that of steel or brass the only difference being in the corroding media Authorities agree than if a part is under stress when in contact with corroding media the intercrystalline corrosion will be intensified Williams and Homerberg believe that when the duralumin part is under stress and brought in contact with corroding media there is a rapid absorption of the media at the grain boundaries and corrosion progresses into the part along the grain boundaries as the metallic compounds are decomposed

The tensile properties are materially affected by intercrystalline corrosion Sheet duralumin may be decidedly embrittled depending on the intensity of the attack by the corroding medium The author believes that intercrystalline corrosion is serious, regardless of the size of the cross section, due to a localization of stresses at points where the cross section is reduced due either to corrosion or tool marks It is common practice today to reject airplane engine crankshafts on account of a scratch barely visible to the naked eye

Protection of Duralumin

The methods used in protecting duralumin against both intercrystalline corrosion and common corrosion are varied and are governed by the severity of the conditions encountered An intelligent use of a protective coating will lead to a considerable saving in initial cost and maintenance and therefore the conditions under which an airplane is to operate should be thoroughly studied before a definite decision is reached on the type of protective coating to use It is obvious that an airplane operating near or over salt water should be much better protected than one which is used for flying in the interior

Aluminum owes its stability to a great extent to the formation of a thin aluminum oxide film when a freshly cut or polished surface is exposed to ordinary atmospheric conditions This fact has led to the development of a protective coating by intensifying the surface oxidation and is accomplished by the anodic oxidation process. Skinner and Chubb were among the first to utilize the anodic process Their best results were obtained by using a sodium silicate solution as an electrolyte It has been found recently that a warm solution of chromic acid as an electrolyte gives good results The oxide coating obtained by the use of chromic acid solution has a very smooth glassy surface and no visible cracks appear when the coated sheet metal is severely bent If the oxide coating obtained by a warm solution of chromic acid is covered with a thin layer of grease by immersing the article in a solution of grease, such as lanoline or lard oil, in a suitable solvent like gasoline, it will be well protected against atmospheric corrosion. A similar coating can be obtained without the anodic process by immersing the part for fifteen to thirty minutes in a hot solution, generally containing a chromium salt and potassium bichromate The results obtained vary with the solution used and the condition of the surface of the part Tevis suggested an oxidation method whereby castings or forgings of relatively large cross sections could be oxidized This consists of covering the surface with a layer of chromate or other easily reducible chromium salt by brushing or immersing the part and then heating to a red heat

Sodium silicate (water glass) has been found to give an appreciable protection to aluminum alloys If the sodium silicate treated surface is baked at a temperature of 300 deg F for several hours it will give a protective surface that will stand rather severe corrosion such as the "salt spray" The sodium silicate coating will, however, crack if the part is subjected to bending, but for parts that are not subjected to bending such as aluminum alloy carburetor parts this coating has a decided advantage

For severe corrosive conditions paint varnish, or enamel coating appear to be the most satisfactory The most commonly used coatings are of the three general types, clear spar varnish, aluminum-pigment spar varnish and bituminous varnish The bituminous varnish is used for protection against severe corrosion The varnish coatings are used for protection against atmospheric corrosion Both the pigmented varnish and the plain varnish will "blister" under severe corroding conditions, but this can be eliminated by giving them a protective coating of aluminum paint made with spar varnish

The objection to the varnish type of coating is that it is easily scratched and before such injury to the coating is remedied serious corrosion may set in A very good protective coating can be obtained by rubbing the surface with a thin coating of adherent oil Such a coating has to be renewed quite frequently but it stands up well under rather severe corroding conditions The resisting properties of an oil coating can be improved by dusting the oil film with alumin "bronze" powder An oil coating has the advantage of being very flexible and easily renewed Its disadvantage lies in that it is messy and will soil the passengers' clothes Another good scheme for protecting the duralumin is to give it a periodic polishing Polishing cleans the surface and causes the surface to flow and fill up any irregularities that may have occurred due to corrosion or other causes Polishing is for all practical purposes as good as an oil film, but it must be done at least every three weeks or oftener The disadvantage of polishing is that it is practically impossible to polish irregular surfaces

Other Methods of Protection

The Schoop metal spray process for protecting duralumin consists of spraying pure aluminum on to the duralumin part by means of a gun This protective coating has the disadvantage of being inelastic, and that the coating in spots may be bridged from one particle to the other without being in contact with the duralumin surface

The Alclad process developed by the Aluminum Company of America offers the possible solution for the protection of duralumin type alloys The exact process is not known but it is generally believed that it consists of hot rolling a thin sheet of pure aluminum to each side of the alloy sheet so as to weld the pure aluminum to the alloy The Alclad process provides a protective coating that stands up very well under severe corrosive conditions Results of a corrosion test are shown below


Fig 1


Fig 2


Fig 3

Results of a corrosion experiment with Alclad Aluminum alloy sheets The samples in Fig 1 are (left to right) entirely alloy aluminum and alloy and entirely aluminum The micrographs Figs 2 and 3, show the surface conditions of the left and center samples respectively after immersion for a week in a six per cent salt solution containing hydrogen peroxide

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